*This Issue*: Advance Papers and Information on Coronado Conventions

# JOURNAL OF ELECTRICITY

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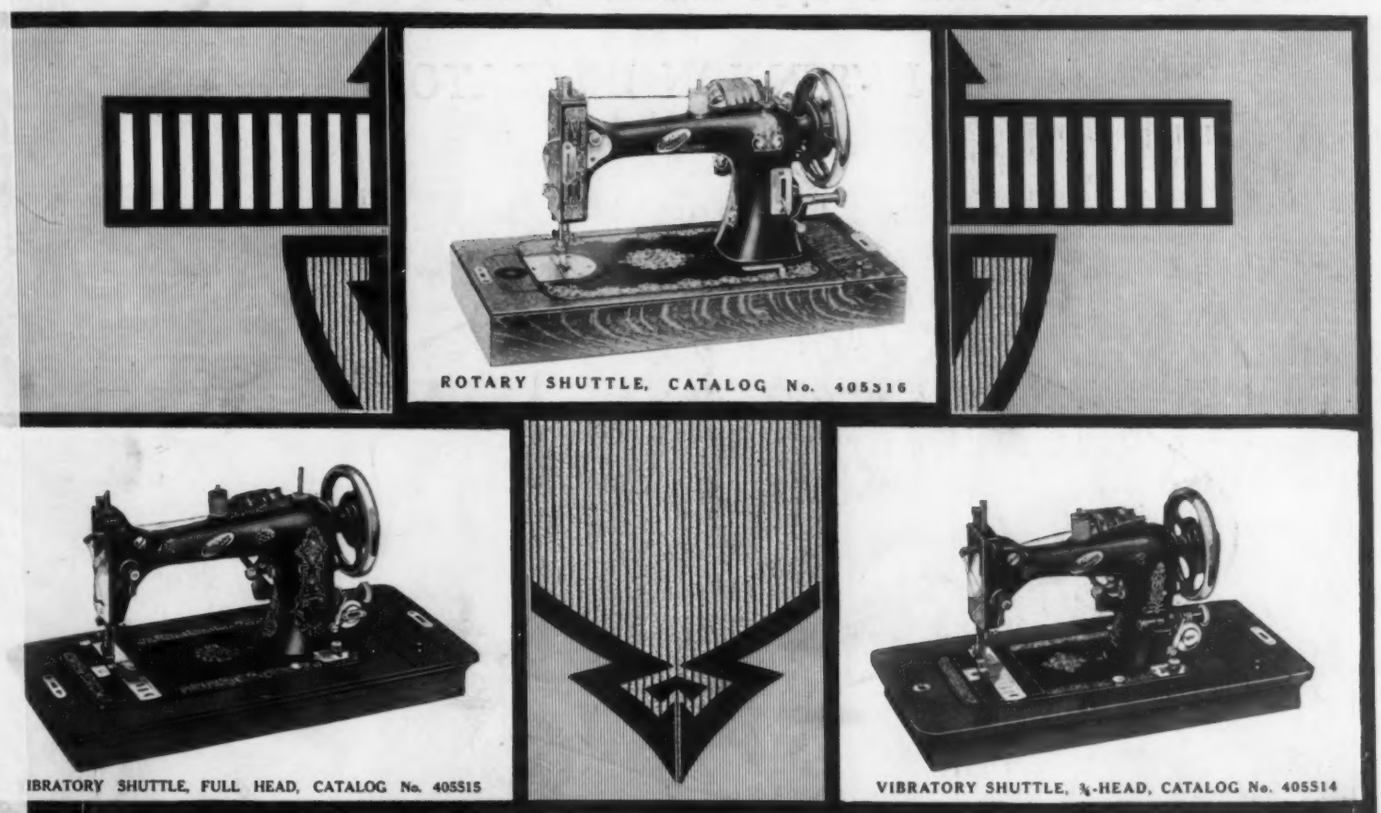
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# JOURNAL OF ELECTRICITY

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ROBERT SIBLEY, Editor — CLOTILDE GRUNSKY, Associate

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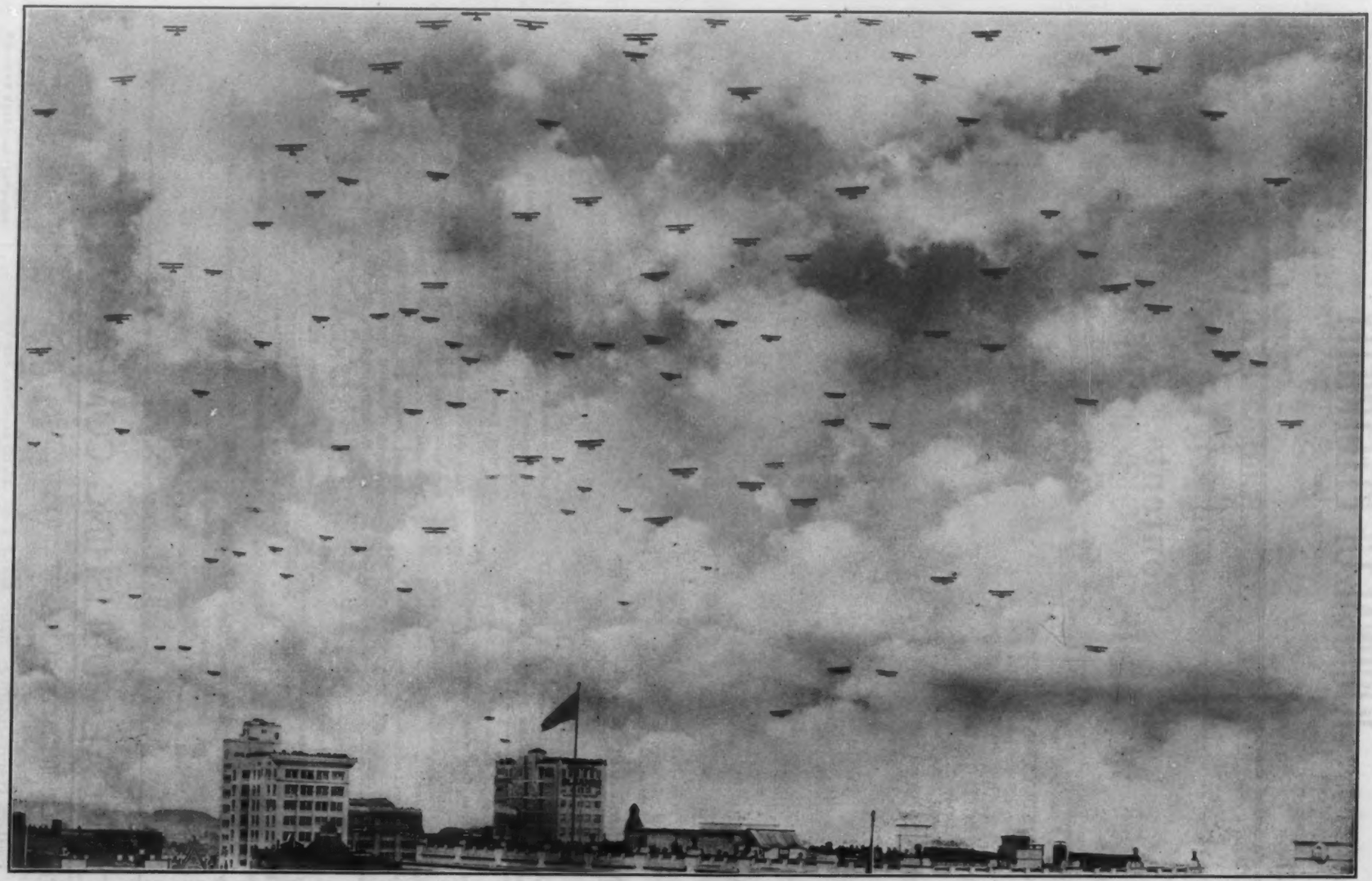

**AEROPLANES HOVERING OVER SAN DIEGO: — As the aeroplanes proved to be the eyes of our victorious armies in the trying period of the war, so the men of the electrical industry convening at San Diego the latter part of April and the early part of May will sense the new needs of industry in these days of giant readjustment and thus enable the West to maintain its position of daring in engineering accomplishment and contribute from its native values a substantial part in the destiny of the new world now before us.**

—Photograph by Kearny Photo Service

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# JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 42 SAN FRANCISCO, APRIL 15, 1919 Number 8


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**VICTORY LIBERTY LOAN! Keep the boys proud of the fact that they fought for you. It's not much of a sacrifice in comparison with theirs, is it?—and it helps you to some feeling of self respect when you see a boy on crutches. Keep our honor as clean as they have kept it. We have no right to claim the victory until we have paid the bill. FINISH THE JOB.**

**The Journal of Electricity**

The Journal of Electricity extends its greetings to the great conventions soon to convene at the Coronado Hotel at San Diego, California. The Pacific Division of the National Electrical Supply Jobbers' Association, the California Association of Electrical Contractors and Dealers and the Pacific Coast Section, N. E. L. A., have indeed passed through trying days in the year just completed but, like our great allied armies who fought shoulder to shoulder in a common cause, they have emerged gloriously victorious.

Perhaps in no other quarter of the world did the electric power industry rise to meet the emergencies of the world crisis by more efficient performance of feats in engineering and economic design hitherto thought unattainable than in the region west of the Rocky Mountains, where electricity is used per capita to a degree representing four times the per capita use prevailing in the remainder of the nation.

And in the performance of these war time duties it fell to the lot of the Journal of Electricity to be the medium for the instilling of hope, courage and constructive imagination to the industry at large. The task was undertaken and that its columns in editorial and advertising strength grew to proportions which place it today among the great electrical periodicals of the day offer the best proof that this aid proved of value to the industry it has tried so whole-heartedly to serve.

This opportunity is taken to thank our advertisers who have so generously backed the endeavors of the Journal of Electricity to be of service and to express our deep appreciation to the industry at large for the magnificent encouragement that has been given us from all sections of the nation.

---

**New Advances in Automatic Control**

In the West, during the period of war stress, many helpful economies in power development were brought about that must inevitably be felt in the industrial life of the nation for many years to come. Not only was the production of fuel oil increased but the generation and utilization of electric power both from water resources and from fuel supply was vastly forwarded. In some instances the task involved the establishment of new records in magnitude of engineering attainment such as the interconnected systems of long distance power lines which have not been even approached in length of transmission or magnitude of distribution anywhere else in the world.

But perhaps the advances that have been made in automatic control will ultimately prove of even more lasting benefit to the industry in lessening labor costs and hence in decreasing the cost of power production, than any other single cause.

The one-man cars for street railways, the automatic control of substations such for instance as the new installation from Salt Lake City to Salt Air in Utah, and the automatic control of power house generators as installed quite recently by the San Joaquin Light & Power Corporation, are forceful instances of this recent trend in economic design.

The Crane Valley power house of the San Joaquin Light & Power Corporation is of unusual interest. Here it is estimated that an average of over three million and one-half kilowatt-hours will be saved by taking advantage of power not hitherto used in the rise and fall of the lake level of Crane Valley Reservoir.

The unusual feature of variable head, ranging from 120 feet down to 80 feet, has been successfully overcome. This power house, in addition to a second installation below, is operated without attendants and only the regular dam tender and reservoir tender make visits to the plant from time to time. An alarm system is installed in the caretaker's cottage so that he is notified if the machine is tripped off the line. The machine, in the meantime, may attain runaway speed. However, should the machine trip off the line and increase in speed, a centrifugal switch on the shaft of the unit closes a circuit on the wicket gate, operating a motor which closes the wickets and shuts down the machine. The water in the ditch immediately starts to rise, and flows over the weir by-pass until such time as the caretaker

of the plant arrives and puts the machine back on the line.

The recent advances in automatic control witnessed on all sides combined with the irresistible trend toward outdoor switches and transformer stations augur well for increased economic power generation and lend a certain hope to the power situation that is certainly pleasing to contemplate.

---

**Sidelights on Engineering Education**

Someone has wisely said that the thoughts of the man largely determine what the man really is. So in the engineering profession, analysis of the thoughts that are creating the driving vision for effort on tomorrow will give us the best idea of the engineer of today and as a consequence we may formulate some outline for fundamentals that should prevail in the education of the modern engineer that he may render the highest service to the nation.

A casual glance over the papers in this issue of the Journal of Electricity—papers that represent the technical study of a great industry in the nation in its preparation for annual convention study—reveals the fact that fully fifty per cent of effort is devoted to questions directly concerned with finance, economics and public relations. The remaining papers deal with engineering discussion of a technical nature, but fundamentally, here too, technical knowledge is not of itself sufficient. Public relations, finance and economics again play a vital part in the choice of design.

It is not to be denied that highly specialized training will always be in demand but the engineer versed in economics, finance and a fundamental knowledge of executive control combined with the foundation for building ideals of statecraft and public relations must be acknowledged as the highest and most useful type of citizenship, and the type that will make the largest numerical demand upon our engineering schools and colleges.

Unquestionably the undergraduate days of the engineering school must be devoted more to meeting this broader requirement for citizenship.

On the other hand, to prepare men for the demands of highly specialized work the thought is suggesting itself continually to the professional engineer that our great universities and colleges must have more of nation-wide cooperation among themselves, looking toward an avoidance of duplication of effort. Let there be but one university in America, for instance, where ceramic engineering is developed to its highest degree, another where electric storage battery engineering is supreme, still another for high tension study, and so on down the list. Such a nation-wide coordination would make it possible for the engineer who in his undergraduate days has laid a splendid foundation in fundamentals to go at a later date to that particular institution where his particular needs may be met.

For this higher work not only must close cooperation among universities be maintained but the contact with the business and professional world must also prevail.

It appears that with few exceptions practically all American schools of engineering plan their undergraduate curricula with a view primarily to technical and professional training, to the neglect very often of opportunities for contact with certain departments of instruction which have much to offer in the way of vital preparation for citizenship and the conditions of modern political and economic life. Consequently any revision of curricula in a single institution will probably be difficult, unless there can be set in motion a plan for revision and reorganization which shall be nation-wide.

Men of the electrical industry can do much in helping to formulate the new vision for engineering training and it is to be hoped that more thought may be given to this important subject.

---

**The Passing of the Railway Excursion**

Perhaps no other factor has proven more helpful in former years in the development of the vast undeveloped resources of America than its magnificent system of railways.

In the West this has most emphatically been the case. Literally millions of American citizens have been transported westward, often seeking only relaxation, but later to become so impressed with the tremendous opportunities awaiting personal touch as to become an enthusiastic and integral part of the human element engaged in developing the values native to our wonderful country.

But the railways did not stop here. The dining cars were laden with the products of the soil over which the road passed, the car libraries were profuse with carefully selected magazines giving valuable general and technical information concerning the production and natural resources of the country, and special excursions were encouraged in instances where the event was to partake of vital discussion pertaining to more efficient, economic and intensified development of the section of country served by the railway.

But now it is to be regretted that things are different. The dining car service partakes of a standardization and sameness from one end of the country to the other. No longer are helpful magazines carried in the libraries and buffets, and as for the excursion, it is a thing of the past.

The case of the helpful convention that is to be held at Coronado Hotel April 30-May 2 is a striking instance. The transportation manager for this, the greatest of all conventions electrical in the West this year, reports that the United States Railway Administration refuses to grant any concessions in rates over the established schedule of 3 cents per mile, and also requires that railroad tickets and Pullman accommodations be purchased outright. While we cheerfully accepted these restrictions during the period of war time necessity there is considerable question at this time as to the need for continuing such drastic restrictions.

As an instance of the vital part this convention plays in aiding the government in its work, it will

be recalled that this same convention met last year at Del Monte and was largely responsible for the concerted and united effort on the part of all central stations in this vast territory which was evidenced in the conservation and pooling of power resources and the saving of fuel oil. This action, too, was undoubtedly reflected in promoting the government's program of shipbuilding on the Pacific Coast and other war industries.

It is unfortunate that so little cooperation is displayed by the government in this typical instance. Under this policy the West perhaps will suffer least of all, for with her splendid system of highways and possibilities of outdoor life, the automobile will now be appealed to more than ever before and doubtless in large measure will fill the need denied by the Railway Administration. But to the country as a whole the problem is not so easily disposed of. Without concessions of some sort, however, the railway will unquestionably pass in its usefulness as one of the prime factors in the furtherance of national development, and unfortunately much of its productive revenue will be diverted to other means of transportation.

---

**The New Angle on Railway Electrification**

No longer can the engineer afford to view great problems of the day in any other light than in its broadest aspect, devoid of selfish interest and partisan feeling. The recent action of one of the largest sections of the American Institute of Electrical Engineers in unanimously approving the appointment of a comprehensive committee from among its most distinguished engineer members to investigate railway electrification is a beginning in the right direction and is highly to be commended.

It is doubtful if an economic problem of more stupendous magnitude confronts the nation today than that of railway electrification. But while the problem in itself is of vast proportions, the resulting good to be accomplished is within the same order of magnitude.

It is quite generally recognized that seven major reasons exist for urging upon the nation as a whole an early beginning in the matter of systematic extension of the method electrical in railway operation. As tersely put by an eastern engineer in a recent address, these seven major points are:

(1) The necessity for freer movement of traffic over existing track facilities.
(2) The greater strength of rolling stock, permitting the operation of higher tonnage trains.
(3) The availability of large amounts of electric power now produced at advantageous cost.
(4) The greatly enhanced cost of fuel which it is believed will remain permanently at a high figure.
(5) The need for more expeditious movement of trains, due to the modified conditions in the employment of labor in train service.
(6) The general shortage of both skilled and unskilled labor available for railroad operation and maintenance.
(7) Recognition of need of increased capacity for movement of traffic, thereby avoiding embargoes and removing the restriction of growth and general prosperity.

Railway electrification is a matter not alone of interest to the railways and their owners, but, first and foremost, to the people at large it is of prime importance. There has been enough authentic data accumulated and published broadcast throughout the nation to convince thoughtful men that economies to be gained and vast conservation in natural resources to be brought about through railway electrification are well within the range of possibility. Indeed, so evident is this fact that every possible pressure should be brought to bear upon all parties to the issue to give the matter the freest and fullest investigation.

We hear much nowadays about the broadened field of usefulness of the engineer and our national engineering societies are urging upon our membership to engage more and more in the helpful solution of present day problems confronting the nation. What greater problem is there before the public today than the matter of bettering our transportation facilities and conserving our fuel resources?

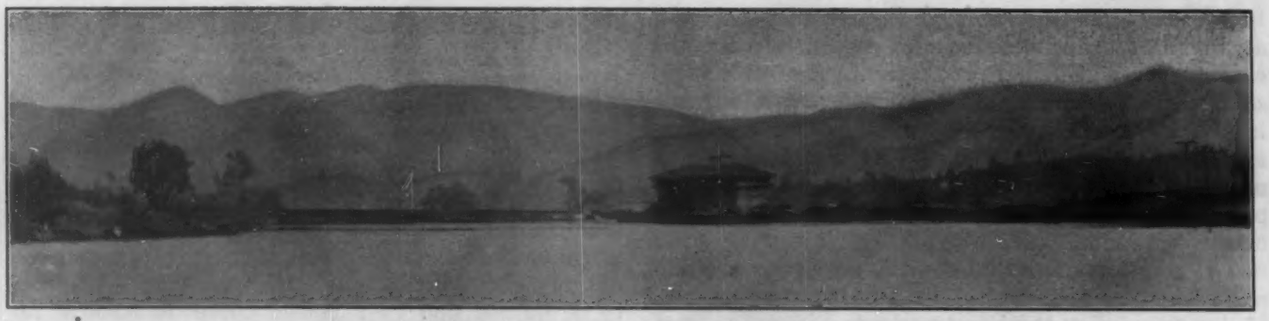
We are informed that the electrical engineer for one of the great transcontinental systems of the West has offered to place at the disposal of a representative group of electrical engineers from the section of the Institute above referred to, any data in his possession that would shed light on this problem.

In view of the importance of this problem before the public at large and before the engineering profession in particular, it is highly desirable that the West take the lead in its solution.

Data collected and analyzed by a group of engineers representing the power companies, the transcontinental railways, the telephone company, the regulating commission, the forest service, the engineering staffs of the two leading universities of the West, and the profession at large, cannot help but add a breadth of vision not hitherto attained in discussions of this important problem.

And best of all, the move in itself heralds the entrance of the engineer into a vastly broader activity than formerly attained in the profession of engineering. The great world war has proven his ability to save the nation in trying days of international carnage. Will the engineer now maintain this magnificent status and prove to be the leading factor of helpfulness in the days of vast world readjustment immediately ahead? The answer is most emphatically, yes.

**THE NEW JOURNAL SERVICE:** The feature of the Journal of Electricity for May 1, 1919, will be the paper of S. M. Kennedy, general agent of the Southern California Edison Company, which is to be read before the Coronado Convention of Pacific Coast Section N. E. L. A. in the session of the commercial section on Friday afternoon, May 2, 1919. We are not at liberty to announce the character or title of the paper and the Journal of Electricity will be withheld in distribution at the convention until the hour of delivery of this paper, but suffice it to say that the national reputation Mr. Kennedy enjoys in matters pertaining to the upbuilding of the industry assure our readers an unusual treat. In addition to this paper an article by W. D.'A. Ryan, illuminating engineer for the General Electric Company and designer of the beautiful illumination features of the Panama-Pacific International Exposition will be contained in this issue. Complete convention discussions taking place at three Coronado conventions will appear in the Journal of Electricity, May 15, 1919.



Power House 1-A is located at the forebay reservoir above power house No. 1 and makes use of a fall in the water conduit system just above the penstock.

# Automatic Induction Generator Plants

BY E. A. QUINN

**(Two small power plants which make use of the water normally used in the larger plants of the San Joaquin Light & Power Corporation under heads which existed in the flow line but had hitherto not been utilized, are here described by the general superintendent of the company. The plants are operated without attendants and represent a unique development brought about by the war. The paper is part of the Engineering Committee Report for the convention of the Pacific Coast Section N. E. L. A.—The Editor.)**

War time conditions, requiring such a vast amount of additional electrical energy, spurred on all Central Station companies in an effort to meet the additional demand and to forestall the threatened shortage of power. One result of this effort

Power House 1-A in the course of erection. The head under which this operates was formerly unutilized.

was the interconnection of the transmission systems of the hydro-electric companies in the state of California; divided into two groups, one including the group of companies in the northern part of the state and the other including the group of companies in the central and southern part of the state. Every effort was made to increase the output of hydro-electric energy, to decrease as much possible the consumption of oil for fuel. The San Joaquin Light & Power Corporation's contribution to this effort was the laying of 22 miles of 6 in. welded pipe, having a capacity of 6,000,000 cubic feet of natural gas per day, for use under the boilers at the Bakersfield steam plant, and the construction of two induction generator plants utilizing the water which is normally used through the San Joaquin River plants under heads which existed in the flow line and heretofore had not been used.

These induction generator plants are known as the "Crane Valley Power House" and "Reservoir 1-A Power House."

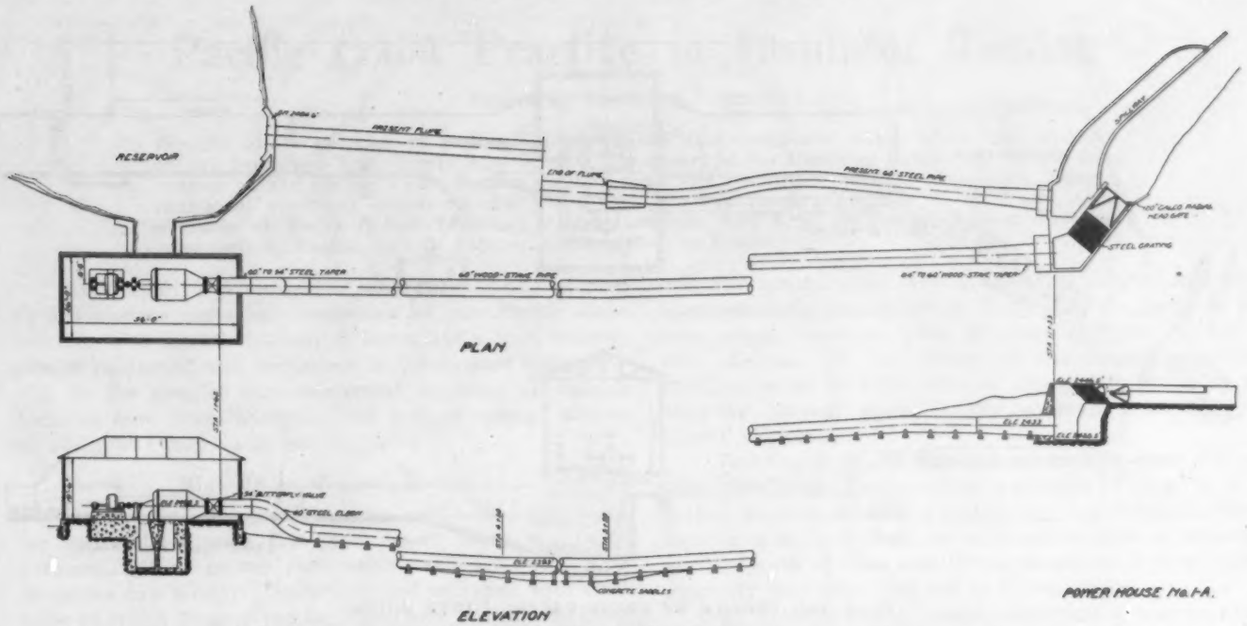
From a tabulation of the flow of water through the San Joaquin conduits covering a number of years, the average yearly kw-hr. output of the Crane Valley Power House will be 3,503,000 kw-hr., and that of Reservoir 1-A Power House will be 2,948,000 kw-hr. A description of these plants follows:

### Crane Valley Dam Power House

This power house is installed just below the dam, and utilizes the head of the stored water, the maximum head being 120 ft., the minimum operating head 80 ft., and the wheel designed for best operating efficiency at 100 ft. head. The water is

The 1-A turbine being set up. With an inductor generator type of station, it is feasible to utilize low leads and small amounts of water as well as to do away with governors, exciters, field rheostats and other devices which require attendance.

drawn from the lake through a gate tower connecting with a concrete lined tunnel 600 ft. long, 6 ft. high and 5 ft. wide. For a distance of 120 ft. a 48 in. steel pipe is concreted into the tunnel, the pipe tapering to 42 in. and then to 36 in., at which diameter it connects to the turbine. A hand operated 42 in. butterfly valve is installed in the 52 in. pipe. Just above the butterfly valve the 48 in. pipe is used as a manifold having 12 12 in. pipes and valves for allowing the discharge of the water into an intake basin at the head of No. 3 ditch, which permits of the by-passing of water through the ditch in the




**DETAILS OF POWER HOUSE 1-A**

Power house 1-A is located at the forebay reservoir at the head of the penstock for Power House No. 1. The unutilized head here was 42 ft. A forebay was constructed and a 60 in. redwood stave pipe 944 ft. long in the form of an inverted siphon carries the water to the power house.

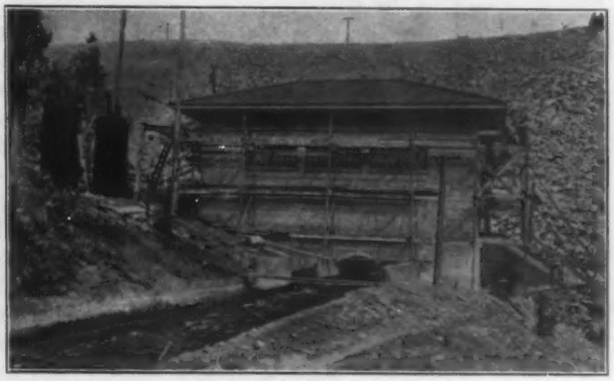
event that the butterfly valve is closed and the power house is shut down. The power house is built directly over the No. 3 ditch, the draft tube of the unit emptying into this ditch. A gate is installed further down the ditch below the power house so that the water from the lake can be used through the power house and either taken down the natural channel or down the No. 3 ditch.

Crane Valley Power House, showing manifold discharge pipes and section of ditch. The attendant at the dam is notified by signal if the machine trips off the line, otherwise the plant receives only occasional visits.

The water wheel has a capacity of 1740 h.p., and is of the left-hand single discharge type, operating at a speed of 450 r.p.m. The bronze runner is of the mixed flow reaction type, designed to withstand the maximum runaway speed that the unit can attain under an effective head of 120 ft. The wicket gates are so shaped that they tend to close if disconnected from the hand control.

The generator is rated at 1000 k.v.a.—2300 volt, 3 phase, 60 cycles, is of the squirrel cage inductor type, and is designed for 100% overspeed. The unit is operated without a governor, but provisions have been made so that a governor may be installed should it be found desirable to do so.

The current from the generator is brought to a switchboard upon which is mounted an automatic oil switch, ammeters, voltmeter and integrating watthour meter. The speed of the unit is indicated by a voltmeter operated from a direct current mag-



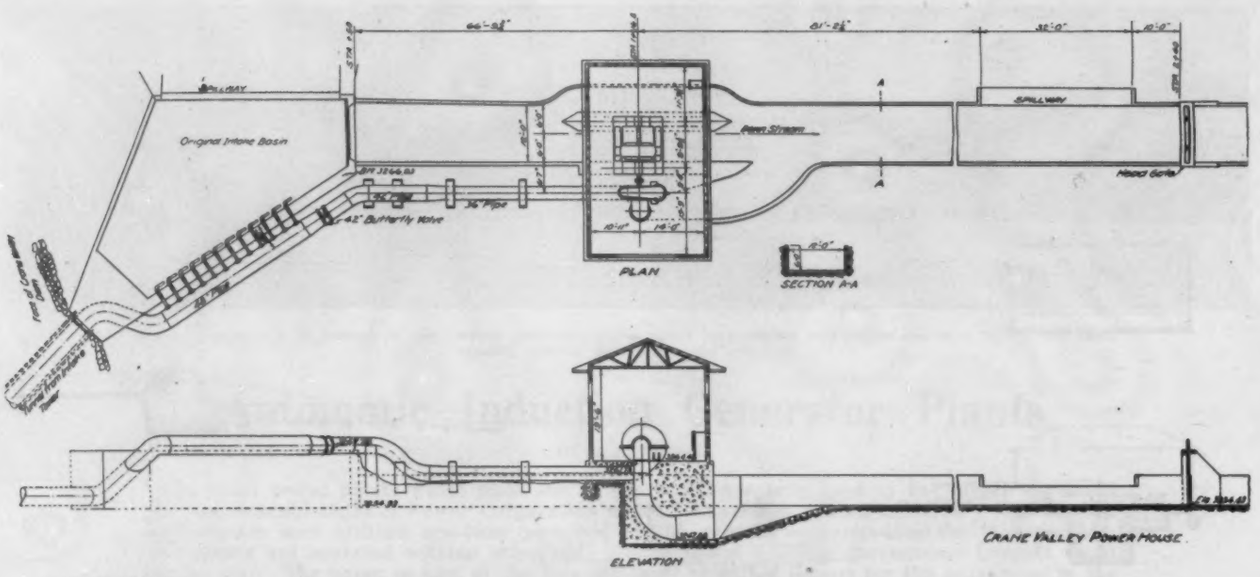
The Crane Valley Dam Power House is installed just below the dam and utilizes the head of the stored water which varies from 120 ft. to 80 ft.

neto belted to the generator shaft. The current is stepped up through three 400 kva. oil filled, self-cooled transformers to 70,000 volts, and is carried over seven miles of line, passing through a 70,000 volt automatic oil circuit breaker where it connects to the main transmission line.

### Power House 1-A

This power house is located at the forebay reservoir at the head of the penstock for No. 1 Power House. The 3½ mile conduit which carries the water from the discharge at No. 2 Power House to

VASSALS can wait to be forced — not you
—Victory Loan




**PLAN AND PROFILE OF CRANE VALLEY POWER HOUSE**

This power house was constructed to take advantage of the varying head in the reservoir. The water is drawn from the lake through a gate tower connecting with a concrete lined tunnel, thence through a steel pipe to the turbine.

the No. 1 Reservoir ends at a point which has an elevation of 42 ft. above the high water level in the reservoir. The water was carried through 1100 ft. of flume from the ditch to the reservoir, and it was decided to utilize this head by paralleling the flume with pipe and constructing a plant to operate on the flow of water in the conduit.

The unit consists of a 600 h.p. end inlet single runner, double discharge, mixed flow reaction turbine operating at a speed of 240 r.p.m., the runner and shaft being designed to withstand the runaway speed which can be attained under an effective head of 39 ft. The casing is of riveted sheet steel, cylindrical in form. The wicket gates are of such shape that they tend to close if disconnected from the hand control. The turbine is direct connected to a 425 k.v.a. squirrel cage inductor type generator; 6600 volt, 3 phase, 60 cycle, designed for an overspeed of 100%. The unit operates without a governor. The current is brought to a switchboard upon which is mounted an automatic oil switch, voltmeter, ammeters and integrating watthour meter. The speed of the unit is indicated on a direct current voltmeter actuated by a magneto generator belted to the generator shaft.

At the end of the No. 1 conduit a forebay was constructed. From this forebay is taken a 60 in. redwood stave pipe 944 ft. long. It is in the form of an inverted siphon, the lowest point being 15 ft. below the center of the water wheel shaft. The staves are 2½ in. thick and the bands ⅝ in. in diameter; the band spacing having a safety factor of 5, and the bands having a tensile strength of from 55,000 lbs. to 65,000 lbs. per square inch. The upper end of the pipe is tapered through a length of 25 ft. from 84 in. to 60 in., and the connection to the butterfly valve is made through a steel pipe tapering from 60 in. to 54 in.

As the quantity of water flowing may vary from time to time, it was found necessary to devise some means of controlling the opening of the wickets to compensate for the increase or decrease in the amount of water in the ditch. This is effected through the means of a float switch in the ditch which operates a motor on the turbine wickets in such a manner as to keep the water in the conduit at a constant level over the intake of the pipe.

An automatic spillway weir was connected in the conduit so that in case the unit is shut down the water spills over this weir and is carried to the reservoir through the existing flume and pipe line, thus by-passing the plant and eliminating any waste of water. Should the machine trip off the line and increase in speed, a centrifugal switch on the shaft of the unit closes a circuit on the wicket gate operating motor, closing the wickets and shutting down the machine. The water in the ditch immediately starts to rise, and flows over the weir by-pass until such time as the caretaker of the plant arrives and puts the machine back on the line. The float on the control operates to keep the water at a level just below the weir spilling point.

These power houses are operated without attendants, the regular dam tender and reservoir tender making visits to the plants from time to time. An alarm system is installed in the caretaker's cottage so that he is notified if the machine is tripped off the line. The machine, in the meantime, may attain runaway speed.

With an inductor generator type of station it becomes feasible to use low heads and small amounts of water power, which would not be practicable if synchronous machines were installed, requiring a complicated installation and necessitating constant attendance. With the type of power house as described above, governors, exciters, field rheostats and other auxiliary devices are eliminated, together with their consequent troubles and attendance.

# Pacific Coast Practice in Insulator Testing

Report of Insulation Committee

**(Pacific Coast practice in testing insulators and the conditions which affect the accuracy of the tests are here briefly described in the report of the Insulator Committee for the convention of the Pacific Coast Section N. E. L. A. The committee consists of John A. Koontz, chairman, electrical engineer with the Great Western Power Company, C. O. Poole, chief engineer of Sierra & San Francisco Power Company, and J. P. Jollyman, engineer electrical construction, Pacific Gas & Electric Company.—The Editor.)**

This report is a resume of tests as used and adopted by the various operating companies of the Pacific slope together with the effectiveness of same, and a brief description of equipment and limitations of the various methods.

In the case of crew equipment no camp or cooking facilities have been included. This will, of course, have to be added in numerous cases.

### High Duty Megger Testing

**Equipment.**—Megger having at least 1,000 volt generator and suitable scale that will detect resistance values between 2,000 Megohms and infinity and preferably 5,000 Megohms and infinity. Suitable tripod equipped with small table on which Megger can be placed and leveled. Sufficient reinforced lamp cord for connection between insulator under test and Megger. Two-prong fork with 4 ft. wood handle. Two line grounding devices and two hand lines. Total weight of apparatus 80 lbs., one light truck.

**Crew.**—A crew of four men, consisting of two linemen, one Megger-man and a driver have been found efficient for this work, and basing figures on an eight hour day, they will test from 200 to 700 link insulators per day, depending on the number of insulators used per string, height of towers or poles and accessibility of lines, the majority of the time being required for climbing poles or towers, together with setting up and leveling Megger. The Megger has proved itself well adapted for testing link insulators in places on the line where more than one unit is used per string, and from the records of various power companies on the Pacific Coast, as shown in Table 2, it will be seen that Megger tests can be relied upon in all but a few cases.

**Limitations.**—Where a single suspension unit or one-piece pin insulators are used, it is necessary to remove same from the line before testing by Megger. The parts of pin insulators having two or more shells can be Meggered provided suitable contact is made to moistened cemented surfaces on both sides of the shell. This, however, is a slow and tedious process and we do not believe has ever been used for testing units in any great number.

The high duty Megger will not give good results in foggy or rainy weather, and in general, trouble will be experienced on cloudy or humid days. When difficulty is experienced on account of damp weather, it is possible to get fairly reliable results by using the guard terminal after having properly cleaned the insulator, and in times of very severe weather conditions, the insulator can even be coated with oil for the period of testing. The time required and possibilities of not obtaining all the surface leakage current through the guard terminal places damp weather testing in the emergency class, and in general should only be resorted to for emergency conditions.

Insulators subjected to salt water spray, or to trade winds near the ocean shore, will be very difficult to megger and in general results are not very reliable. Link insulators next the wire and the tower in long suspension and dead end strings will usually show slightly lower megger reading than those in the center of the string, even though the insulators be in good condition.

The present high duty Megger will not always detect interior cracks in heavy porcelain parts which are entirely free from moisture, but there are few localities on the Pacific Coast where the atmosphere is so dry that the cracks do not soon become moisture laden, in which case the Megger is very effective. If the voltage of the Megger generator could be raised to 5,000 volts or above, this defect of not detecting internal cracks in dry insulator caps would be largely eliminated.

**Test Standard.**—Any good insulator with clean dry surfaces should have an insulation resistance of from ½ to ¾ million Megohms so that if an insulator has reached a resistance value of 2,000 Megohms or below, it should be discarded as the length of time that it might still be of some use is generally very short and not to be considered.

At times of humid weather conditions it may be necessary to carry two or three good insulators for checks when all insulators give low reading due to surface moisture.

In most places testing with Megger can only be successfully done in the daylight hours and then commencing several hours after sunrise and stopping before sunset. The actual length of time testing can be carried on will depend upon the time of year, proximity of insulators under test to water, and the humidity of the atmosphere.

The effectiveness of systematic Megger testing is shown by the records of one power company operating about 325 miles of 100,000 volt circuits. The practice is to megger all units once every two years and the places where highest depreciation is occurring, once every year.

The lines were first meggered in 1914-15, then again in 1917.

The string of failures which in general indicate service interruptions were as follows:

Prior to meggering—0.5 of one per cent.
First year after meggering—0.1 of one per cent. (This figure is unduly high on account of not changing all insulators at time of test.)
Third year—.06 per cent, while during 1918 the company did not lose a single string of suspension or dead-end insulators on the whole 325 miles of the line.

The majority of these link insulators were manufactured in 1907-1908, and have been in service since that date.

### 60 Cycle High Voltage Test

**Equipment.**—60 cycle source. Suitable voltage control apparatus. Transformers of ample voltage range to flash over the largest single porcelain unit or piece to be tested.

Series gap. Suitable testing racks and leads.

**Crew.**—1 tester, 2 tester assistants.

**Limitations.**—The series gap should always be used in 60 cycle testing. By observing the color and character of the arc across the gap, porous porcelain can be detected. The reddish glow of the arc in the series gap will indicate porous material while the arc will have a bluish "snappy" appearance, that of charging current, for good material.

The test standard for low frequency testing will vary depending on the material tested. Suspension insulators of the later designs should be subjected to flashover four or five times before acceptance, while the thin shells of the older pin

VIM to the end — took money
—Victory Loan

TABLE NO. 1

| TESTING APPARATUS | | PIN INSULATORS | | | | LINK INSULATORS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ONE PIECE | | BUILT UP | | ONE UNIT PER STRING | | MORE THAN ONE UNIT PER STRING | |
| | | Tested in Laboratory | Tested in Place on Structures | Tested in Laboratory | Tested in Place on Structures | Tested in Laboratory | Tested in Place on Structures | Tested in Laboratory | Tested in Place on Structure |
| MEGGER | Suitable except in extremely wet or dry climates. | Can be used | Not suitable | Can be used | Individual parts can be tested but cement must be wetted to get results | Can be used | Not suitable | Can be used | Can be used |
| 60 CYCLE HIGH VOLTAGE | Most conclusive test. | Can be used | Not suitable | Can be used | Suitable extreme case | Can be used | Suitable extreme case | Can be used | Suitable extreme case |
| OSCILLATOR | Will detect defects away from cap in dry insulators. Will sometimes pass low megohm insulators. | Can be used | Not suitable | Can be used | Not suitable | Can be used | Not suitable | Can be used | Not suitable |
| INDUCTION COIL | Results intermediate between oscillator and 60 cycle high voltage. Detects cracks as well as porous insulators. | Can be used | Not suitable | Can be used | Can be used | Can be used | Not suitable | Can be used | Can be used |
| TELEPHONE DETECTOR | Will not detect between leakage over dirty insulator. | Not suitable | Can be used, limited | Not suitable | Can be used, limited | Not suitable | Can be used, limited | Not suitable | Can be used, limited |

type designs should only be subjected to a voltage slightly below flashover for a period of five seconds.

We consider this method of testing the best laboratory method and it has been used in field laboratory work. One of the largest operating companies of California is seriously considering developing a low frequency test for checking insulators in place.

It is possible to detect porous shells on pin insulator without subjecting the thin parts to flashover and the possible breakage due to the power arc.

When testing porcelain with low frequency high voltage, care should be used to properly protect the test equipment against any heavy current flow or the breakage from the heat generated in the arc will be unduly high.

### Oscillator Testing

**Equipment.**—High voltage oscillator having ample voltage range to flash over pin insulator or one unit of suspension string. Suitable voltage control equipment for handling oscillator. Alternating current voltage source. Crates for handling insulator strings or units to and from towers or poles to field laboratory. Hand lines and grounding devices. Two trucks—total weight 4000 lbs.

**Crew.**—4 linemen, 2 groundmen, 1 tester, 1 test assistant, and 1 truck driver.

**Limitations.**—Because of the size and weight of the equipment the oscillator is not adapted to use for testing insulators in place; hence, must be used for laboratory work. This test laboratory, however, may be readily arranged so it can be transported by auto truck.

The oscillator will not detect certain classes of porous moisture laden insulators. In very dry climates where cracking is the predominant fault in the defective insulators, the oscillator will give good results.

A crew of nine men could remove, test and replace from 200 to 600 units per day, depending upon the number of units per string and the strings per tower. Insulators should stand flash over for at least a five-second period for acceptance.

### Spark Coil

**Equipment.**—Spark coil of sufficient size and voltage range to flash over unit or part of a multi-piece unit. Ignition battery for operating spark coil. Suitable insulated leads for high voltage terminal. Two grounding devices for line equipment. Weight of equipment, 80 lbs. One light truck or touring car.

**Crew.**—2 linemen, 1 groundman, 1 tester and 1 driver. Can test 150 to 500 units per day in place.

**Limitations.**—The spark coil and oscillator are quite similar except the spark coil is of lower frequency and made in smaller sizes so that it is more portable than the oscillator. The spark coil is better adapted for testing the individual pieces of a three or four part pin insulator than the Megger. Perfect contacts with the cemented surfaces on both sides of

TABLE NO. 2.

| Name of Company | Insulators. | | | | Line Data | | | | | Testing Data | | | | | | | | | | Results. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type | | | | | | | | | Apparatus Used | | Frequency of Applied Voltage | | | Standard Required to Pass Test | | | | | | | |
| Southern Sierras | Link | 6 | 1 | 4,500 | | Towers | 6 | Vert. | 10' | 8 | Osc. Motor & 60~ Transformer | 5500 | 200000 | | | | | | 1st Test | 11 | | |
| San Diego Consol Gas & El | Link | 5-7 | 1 | 15,000 | | Steel Towers | 3 | Triangle | 4'-8" | 12 | Megger in field Std. tests in laboratory | | | 1000 | 500 | Should show what they from average To be Replaced | | | Not Worked | 2 | | |
| Portland Ry Lt & Power | Link | 3-4-5 | 1 | Foundry Insulator | | Towers | 3 | Vert. | 6' | 11 | Megger | | | 2000 | 1000 | 2000 megs before removal 1000 megs in lab | | | | 5 | | |
| Los Angeles Consol Electr | Pin | - | 2 | 37000 | | Steel Poles | 3/6 | Pattern Vert. | 3' | 45 | Megger | | | 6000 | 1000 | 2000 megs | 35 KV for one min. | | 2 Units have been used in other Laboratories | 3 | | |
| | Link | 2 | 1 | 15000 | | | | | | | | | | | | | | | | | | |
| Pacific Gas & Electr | Link | 7 | 1 | 22000 & 37000 | | Steel Towers | 3 | Vert. | 10' | 6.6 | Megger. | | | 2000 & 3000 | 1000 | 2000 megs | | | Not Worked | 4. | | |
| | Pin | - | 4 | 45000 | | Steel Poles | 9 | Triangle | 6' | 20 | Induction coil | | | | | Parts and Cement tested as a Unit Electrical | | | | 3 | | |
| Puget Sound Traction Lt & Power Co | Link | 3 | 1 | 22000 | | Steel Towers | 6 | Triangle and Vertical | 6'-9" | 10 | Wireless Telephone Receiver | | | | | | | | | 2. | 1% | Negligible |
| | Pin | - | 4 | 45000 | | Steel Poles | 3 | | | 6-30 | | | | | | | | | | | | |
| Great Western Power Co. | Link | 6 | 1 | 75000 | | Steel Towers | 6 | Vertical | 10' | 8. | Megger. | | | 200 | 1000 | 2000 megs | 35 KV | | Over 100 per day | 4 | 0.5% 0.1% | 0.05 % above |

a porcelain part are not so essential with the spark coil. It will detect porous porcelain or cracks and can be used in places where weather and surface conditions would exclude the Megger.

A shunt gap is used across the terminals of the coil and the quality of the insulator is judged by the length of gap that will arc-over while insulator is under test.

### Telephone Detector Tests

**Equipment.**—Wireless receiver head set. Battery and insulated wire. Suitable light pole, 10 or 15 ft. in length equipped with sharp metal point. Short metal rod for earth contact. In some cases a crystal detector is used to increase sensitiveness with satisfaction, and the Audion amplifier has been used.

**Crew.**—1 specially trained, careful lineman.

**Limitations.**—The telephone detector tests are generally used as a shunt circuit on the wood pole to detect leakage current to earth through the pole. The arcing and overstressing of insulator parts give rise to high frequency currents which will give a distinctive tone in the receiver.

On wood pole construction by going to the cross arm it is generally possible to locate the pin or link string in question, but when the more sensitive devices are used in connection with short antennae on steel towers, only the tower can be determined.

The troubles with these devices are that in general you cannot distinguish between a faulty and a dirty insulator. This is particularly true if it is some of the older pin type designs in which certain of the petticoats may be over stressed due to dirty caps. Thus with many of the older design pin insulators in the fall of the year the first fog or light rain would tend to show all insulators faulty.

On account of the lightness and simplicity of this test it can be used to advantage at times if one realizes its many faults. It will in general at least indicate that the insulators are dirty and should be cleaned, and in many cases the faulty insulators can be determined while the line is in operation, which cannot be said of any of the other methods of test.

For complete details and limitations of tests see article by M. T. Crawford, A. I. E. E., vol. 33, page 1429, and article by B. G. Flaherty, vol. 35, page 1095, together with discussions.

# Emergency Interchange of Power

BY G. R. KENNY

**(The interconnection between the Southern California Edison Co. system and that of the San Joaquin Light & Power Corp., which united two sixty cycle with one fifty cycle system is of especial interest owing to the particularly difficult physical conditions to overcome as well as the complexities of cost adjustment. The author is on the engineering staff of the San Joaquin Light & Power Corporation. The paper is one of those presented by the Engineering Committee for the coming Pacific Coast Section N. E. L. A. convention.—The Editor.)**

An example of satisfactory interconnection of systems and interchange of power under particularly difficult physical conditions is that begun in 1918 between the Southern California Edison and Mount Whitney Power and Electric Companies as one party and the San Joaquin Light and Power Corporation as the other. These companies were facing the same general power shortage conditions as those in other territory as well as a shortage of water supply for their hydro-electric plants. The generating capacity of the Mount Whitney Company which is controlled and operated by the Edison Company is entirely inadequate for the present needs of its territory, which lies in Tulare and Kern Counties, California, and is almost entirely surrounded by territory served by the San Joaquin Company.

The Edison Company operates at 50 cycles, the San Joaquin and Mount Whitney Companies at 60 cycles. The San Joaquin Company transmits at 60 k.v. and the Edison Company at 150 k.v. except south of the Kern River where they have 60 k.v. lines as well. The Edison Company has a 20,000 kilowatt, 50 cycle plant known as the "Kern No. 1," on the Kern River about fifteen miles east of Bakersfield, and the San Joaquin Company a 3,750 kilowatt 60 cycle plant known as "Kern Canyon" about two miles below on the same stream. In addition to other hydro developments the San Joaquin Company has a 12,000 kilowatt steam plant at Bakersfield and the Mount Whitney 6,000 kilowatts in steam capacity at Visalia. During 1918 natural gas was brought into Bakersfield steam plant and all boilers equipped for its use.

### Conditions of Interchange

After some preliminary correspondence and conferences it was decided to interconnect the systems and begin the interchange of power with no definite understanding as to the method of settlement or how great the volume of interchange might be. The joint operation was begun in March, 1918, with the following general understanding of what was to be accomplished. "The intention is to provide a working agreement whereby use can be made by the companies of such parts of the existing resources and facilities for the production and transmission of power as are not needed at the time for the business of the owner, so long as such use and interchange can be made to contribute to the conservation of fuel and the prosecution of the war." It was also understood that settlement was to be on a cost basis. It was necessary to provide means for transferring power from the Edison Company to the San Joaquin and Mount Whitney Companies and vice versa.

In order to provide 60 cycle power the Edison Company operated as many of the four units at Kern No. 1 as were necessary for this service at over-speed and to provide 50 cycle current from the valley, the San Joaquin's Kern Canyon plant was cut loose from the 60 cycle system and operated at 50 cycles. Transformers sufficient to handle about 15,000 kilowatts were installed between the San Joa-

VOICE your thanks for victory

—Victory Loan

quin and Mount Whitney Systems at Strathmore. One of the Big Creek 150 k.v. lines was cut loose north of Magunden and used in the interconnection. In August a 5,000 kilowatt frequency changer set was installed at Magunden. The sketch shows the location of the lines used and the interconnections. All operation in connection with the interconnected 60 cycle system was under control of the San Joaquin load despatcher at Fresno. The general operating instructions were to allow no water to waste if the power could be used to save fuel at any point and to conserve fuel at steam plants by using the most efficient steam plants first, operating at the point of greatest efficiency, etc.

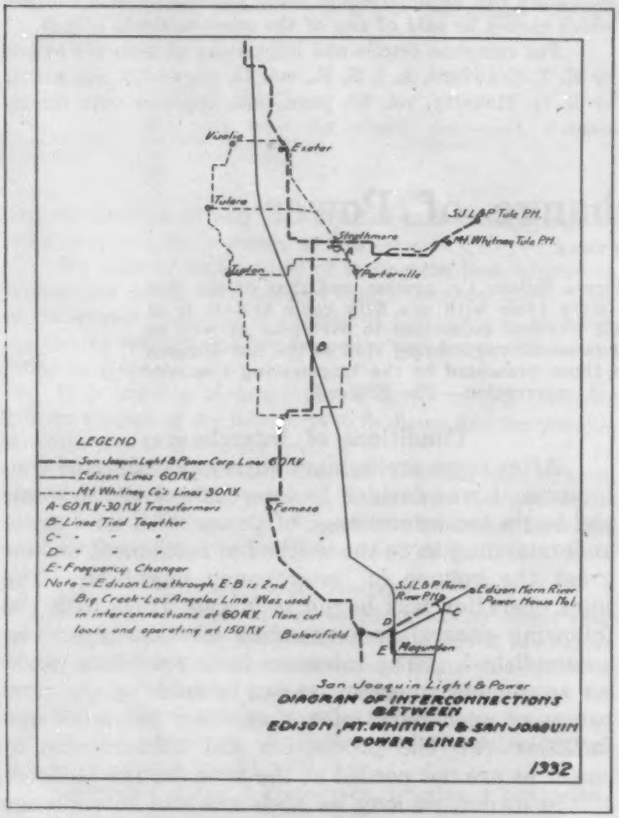

Visalia
Exeter
Tulare
Strathmore
Porterville
Tipton
SJL&P Tule Ph.
Mt. Whitney Tule Ph.
LEGEND
San Joaquin Light & Power Corp. Lines 60 K.V.
Edison Lines 60 K.V.
Mt. Whitney Co's Lines 30 K.V.
A-60 K.V.-30 K.V. Transformers
B-Lines Tied Together
C- " " "
D- " " "
E-Frequency Changer
Note—Edison Line through E-B is 2nd Big Creek-Los Angeles Line. Was used in interconnections at 60 K.V. Now cut loose and operating at 150 K.V.
Famoso
Bakersfield
Magunden
SJL&P Kern River Ph.
Edison Kern River Power House No.1
San Joaquin Light & Power
DIAGRAM OF INTERCONNECTIONS BETWEEN EDISON, MT. WHITNEY & SAN JOAQUIN POWER LINES
1932

**DIAGRAM OF INTERCONNECTING SYSTEMS**
The location of the various elements of the interconnection is plainly indicated on this chart

### Basis for Calculating Rates

The basis adopted for calculating the rates for the various classes of power to be interchanged was substantially as follows:

Power delivered from one party to the other to be paid at the "Additional Cost" of generating plus one half of any saving resulting to the receiving company as against generating at its own plants. By "Additional Cost" is meant only such expenses as would be incurred by the delivering company on account of generating the additional power in existing plants. It was understood that no additional generating capacity was to be furnished by either party for the interchange; that there was no guarantee either to deliver or receive, and that each company was to have the benefit of its own cheapest sources of power. The power to be interchanged was considered under two classes. First: "Surplus Water Power" which was understood to mean power generated from natural flow water which could not be used at the time by the Generating Company, but could be used by the other party to save steam generation. Second: "Steam Power" delivered from any steam plant or water power delivered at such a time that it was necessary for the delivering Company to replace it by steam. All power from stored water was considered to have the same value as steam power.

It was found necessary to determine rates for "Surplus Water Power" for "Edison Oil Steam Power" generated at Long Beach and for "San Joaquin Oil Steam Power" and "San Joaquin Gas Steam Power" generated at Bakersfield. "Surplus Water Power" as defined can be produced by the generating company with no additional cost. An average cost per kilowatt hour for fuel for steam power was agreed upon and one half this cost taken as the price per kilowatt hour for surplus water power from either party to the other at any point with no line losses considered. "Steam Power" rates which were calculated for switchboard delivery on a kilowatt hour basis cover fuel costs based on the price being paid for fuel and the efficiency of fuel use shown by experience to be reasonable plus a small allowance for increase in other operating expense plus one half the saving to the receiving company against its own per kilowatt hour cost arrived at in the same way or plus a small arbitrary percentage agreed upon. These rates were of course understood to be subject to revision if the price of fuel changed. In determining efficiency of steam plants, curves were plotted between monthly output and monthly fuel use in order to determine standby use and actual operating efficiency.

Line losses under expected conditions of operation were calculated for all cases where power was to be transmitted. It was found that in transmitting the expected volume of power from Kern No. 1 over the San Joaquin System to Strathmore the line and transformer losses would average about 10%. The power delivered into the San Joaquin System at Kern No. 1 was replaced for Los Angeles by steam power from Long Beach and charged to the Valley use at the "Edison Steam" rate. The saving in line losses between delivery from Kern No. 1 and from Long Beach was offset by the loss in efficiency in operating the "Kern No. 1" machines at 60 cycles. The plant delivers only slightly in excess of 18,000 kilowatts from the water that would generate 20,000 kilowatts at 50 cycles. The output of Kern Canyon is greater at 50 than at 60 cycles. As the rates were based on cost, it was understood that the party against whom the balance for power delivered stood at the end of the year would pay to the other the amount of state gross income tax paid on account of this earning. Each company furnished and installed short sections of line, switches, and other equipment to provide the necessary interconnections. The largest items were the frequency changer set at Magunden and the transformers at

Strathmore. Where such equipment was used for the benefit of more than one of the parties, interest and depreciation were calculated upon it and together with the additional substation operating expenses incurred prorated to the parties on the basis of the benefits received by each as measured by the kilowatt hours received for final use by each. The quantities of power handled through the interconnection in 1918 are as follows:

| | |
|---|---|
| Surplus Water Power | 5,500,000 kilowatt hours |
| Steam Power | 19,200,000 kilowatt hours |
| Carried over San Joaquin Lines from Kern No. 1 to Mount Whitney System | 38,000,000 kilowatt hours |

### Benefits from Interconnection

The benefits derived from the interconnection may be briefly summarized as follows: The Edison Company was enabled to take care of the load in its Mount Whitney territory. The San Joaquin Company received sufficient power in 1918 to carry its load which it could not otherwise have done. A considerable quantity of fuel oil was saved by the transfer of "Surplus Water Power," (Probably 25,000 barrels). Service was better protected on account of the reserve capacity available. Fuel oil was saved and operating costs reduced by the use of the most efficient steam plants.

The interconnection and interchange was carried out without friction and with the best of feeling and fullest co-operation by all concerned, and is being continued into 1919 with the same understanding as in 1918.

Although the war is over and peace conditions returning the Electric Utilities are still handicapped in new construction and most of the interconnections made are still in operation to as great an extent as during the war. The interchange of power between companies in adjoining territory should result in profit to both if the rates are properly based, as there is a direct economic saving due to greater use of generating and transmission equipment.

# Relay Protective Systems

BY G. E. ARMSTRONG

**(Owing to favorable climatic conditions and to the comparative infrequency of shut downs with hydro-electric generated power, the West has been backward in adopting protective methods against interruption to the service. The advantages to be gained from lines so protected and some of the methods in use on the system of the Southern California Edison Company are here considered by an engineer in the department of generation with that company. The paper is part of the Engineering Report for the spring convention of the Pacific Coast Section N. E. L. A.—The Editor.)**

A great deal has been written and said about protective relays, and the market is well supplied with many ingenious devices which, when properly applied, will do almost anything that can be desired in the way of automatic sectionalization, but, comparatively little has as yet been done to get the benefits which are possible if the devices were used. This applies with greatest force to the Pacific Coast companies as those in the east have already found it necessary to take advantage of the most modern appliances for protecting their systems, due to their load requirements and the character of their transmission construction.

### The West Backward

In the west there are three things which apparently have been the cause of our backwardness in this connection—our favorable climatic conditions, our generation of power by hydroelectric plants, and the fact that our transmission is largely over long overhead lines. These things combine to lesson the number of our interruptions and decrease the seriousness of the ones we have. However, this does not completely explain our lethargy and I believe the reason may be due to either one or both of the following: That the economies are not realized, or the idea is fixed that the individual systems are of such complexity that they cannot be adequately protected by any devices at present developed.

There are, of course, two reasons for applying automatic protective devices to an electrical system. These are the old stock reasons but they bear repetition. One is to make more money by giving better service and so selling more energy, and the other is to make more money by saving that which would otherwise be spent. A momentary dip in voltage during the time between the occurrence of a short circuit and the opening of the proper switches to clear the trouble is far preferable to an interruption of such length as to permit the motor load to drop off the lines. I would not class the former as an interruption. If service were available which was subject to occasional momentary voltage dips only, there would be a very large additional incentive for some power users to change from steam to electricity. When we remember that we are selling service we will see that interruptions cost much more than appears at first glance. The power salesman has constantly to contend with the proposition that, after proving his case from the standpoint of the relative cost in dollars and cents as between private burning of fuel and the use of electrical energy from a large central station system, he has also to prove the very important point of relative reliability of the two sources of power. The consumer demands frequently that he be connected to two or more stations by two or more lines because he cannot be shown that there are such protective devices in service as will allow him to obtain the freedom from interruptions which he demands, should he be connected to only one station.

VESSELS to bring them back

—Victory Loan

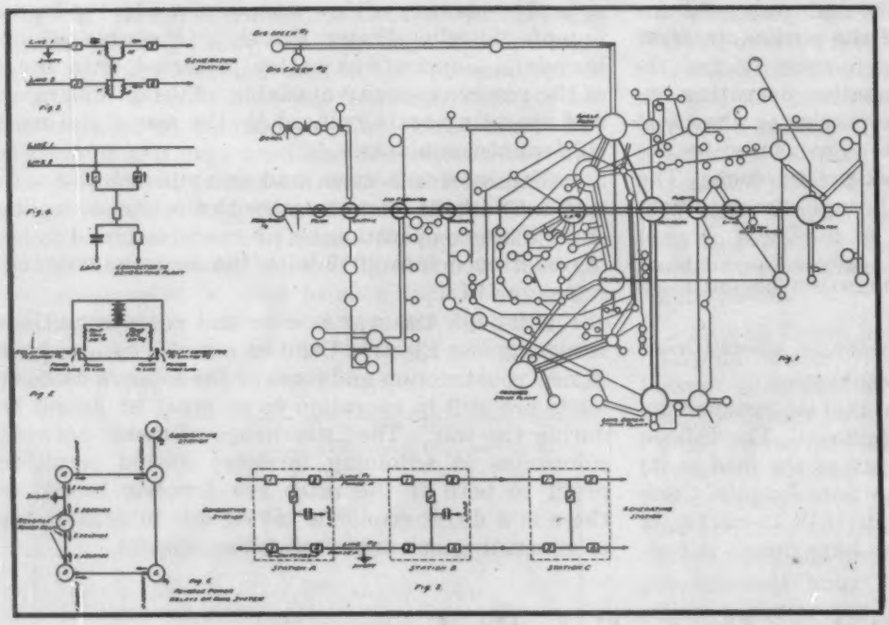


Fig. 1 represents the main transmission system of the Southern California Edison Company. The object has been to provide a substation with four sources of power. Fig. 2 shows two duplicate parallel lines through the stations A, B and C with relays which operate in case of a ground. Another application of the balanced relay is shown in Fig. 3 where the coils are placed in series with the line. A scheme of protective relays which change a station from a single line source of supply to a double line source is shown in Figs. 4 and 5. Fig. 6 illustrates the scheme of using reverse power relays for the protection of single lines which conform to the ring system.

### Saving in Cost

The first point in saving in operating cost if proper protective relays are installed, is the direct reduction due to a decreased number of boilers and steam driven generators which are required as standby for insurance against interruptions caused by line failures. It is an accepted policy that standby plants should be kept in readiness to pick up the load dropped by other plants. If the number of interruptions be greatly decreased, the standby plant will show the saving immediately. This saving will be most noticeable when systems are interconnected for the exchange of surplus power. If one system is depending upon another for power and does not have to maintain a standby plant in anticipation of having to go on the line whenever a short occurs and so breaks up the interconnection, the benefits of the interchange will be most fully realized.

Another item of expense which may be made less if suitable devices are installed is the cost of patrolling lines to locate the cause of short circuits. Although this reduction in operating expense may not be very great, yet it would pay interest on the cost of a large number of relays. For example, a short occurs on a hundred mile line and may require as much as 300 miles of travel for the patrolman to cover the whole line. If the line is properly sectionalized, the location of the short will be known to be confined to a comparatively short section and the patrolling expense will be reduced accordingly.

Quite a large saving may be made by reducing line losses as in the case of duplicate lines, part of which are maintained solely for emergency use. The practice is common with many companies to operate some stations normally on one or more lines and, when an interruption occurs, to switch the stations to the emergency lines. This takes time as well as putting all of the load on part of the lines. The line losses by operating two lines in parallel as against holding one for emergency use, will, of course, be reduced three quarters and the regulation will at the same time be improved.

The question of investment saved by deferring the construction of emergency lines has so many factors that no general conclusion may be drawn other than that it appears that two parallel lines, if of sufficient capacity, should be ample for supplying any installation at least as far as protection of the service is concerned.

### Insulator Tests Avoided

Note might be made that the bugbear of insulator failures may be lessened if proper protection is obtained. Short circuits should lose a large part of their present seriousness if the defective section of line was instantly discontinued before the system was greatly affected. At present large sums are spent to detect and to remove insulators before they fail and interrupt the service whereas it may be more feasible to allow the insulators to fail in service and then remove them. This is, in a way, reverting somewhat to the obsolete theory that things should be run till they stop and then shut down to fix them, but with this change—run them till they stop and then continue to run after they stop and while they are being fixed. Part of the old policy was to "burn off" the shorts, which burning sometimes incidentally included the lines, the poles, and any other items which happened to be in the vicinity. As amended, the policy would be to let the line short but then disconnect it before damage is done. This policy is not advocated as being the correct and only thing to do, but is advanced as being a possibly less expensive method of operating. In the case of load being carried from one source only and over one line only, this policy would be wrong, but otherwise it is a question of the cost of repairs against the cost of removing defective insulators before they fail.

### Choice of Methods

After it is determined that it is proper to "protect," the question is, how to do it. As was said above, the devices on the market are applicable to practically every contingency or condition which may arise in practice and they have had such trials that failure to function properly is due to selection of the wrong kind of relay, or to incorrect installation.

The selection of the proper relays is comparatively easy if the problem is analyzed to the fundamentals. It is agreed that a defective line or piece of apparatus should be disconnected as soon after failure as possible, and all that remains is to determine what are the specific phenomena which accompany the different classes of failures and select the relays that will operate due to these phenomena.

An alternating current circuit or machine, at the time of a disturbance may be subjected to, or cause, any one or several of the items following:

PHENOMENA ACCOMPANYING DISTURBANCES

1. Voltage —
   - (a) Changes as between phases, or
   - (b) To ground
2. Current —
   - (a) Increase
   - (b) Decrease
   - (c) Unbalance as between phases
   - (d) To ground
   - (e) To other circuits
   - (f) Direction of flow relatively as between two or more circuits
   - (g) Direction of flow relatively as between two points on the same circuit
   - (h) Unbalance as between paralleled circuits
3. Power —
   - (a) Changes in direction of flow
   - (b) Changes in quantity
4. Power Factor —
   - (a) Change in power factor

Certain of these phenomena, while accompanying a short circuit, will also be incidents to ordinary operation and therefore may not be used to cause the operation of relays for automatic protection. Others are functions of short circuits or other defects which are to be protected against and may be used knowing that they are infallible indicators. I wish to give special emphasis to the necessity of making some such analysis as this, since upon it will depend the success or failure of the protection system. It should also be remembered that in selecting the devices to be operated by the indications above, that it is not necessary that one single piece of apparatus should be found which will act correctly under all conditions. For example, one design of relay may be installed for one particular purpose and another entirely different kind of relay installed at the same location and be designed to get the same results as did the first relay but be actuated by different phenomena and under different conditions of operation. In fact, one installation in mind is so designed that there are three different kinds of relays all acting to open the same switches and all independent of each other otherwise.

### Fitting Relays to System

One fallacy especially to be avoided is, that there is only one kind of relay available for getting certain results. Some engineers have apparently become wedded to particular types of relays and have made great effort to make their systems fit the relays. As an instance of this sort, a certain mid-western company went to considerable lengths to determine the characteristics of a specified type of relay so that they might apply such relays to their lines when, as a matter of fact, their system was admirably adapted to the use of another kind of relay which would have been much less expensive to install.

The present day tendency of overturning the established order of things may well be applied to questioning the usually accepted methods of installing certain classes of relays. It is not always necessary to purchase high voltage instrument transformers for the operation of relays as potential may be obtained from the low tension side of step-down transformers and current from inexpensive bushing type current transformers. It may be possible in some cases to eliminate entirely the need of instrument transformers by placing the relays at line potential and securing remote control by means of insulated sticks. Although the cost of protective relays even if installed without taking advantage of such expedients as mentioned, is so small compared to the gain, yet it is the lack of information as to what are the costs and savings which is the wall which has held back more rapid progress along this line. In order more fully to illustrate what can be done and done at what slight expense, a number of particular instances of protection schemes will be described and their application to the system of the Southern California Edison Company outlined.

### Methods in Use in Southern California

The accompanying diagram of the main transmission system of the Southern California Edison Company is shown so that one may see how the present methods of operation are being revised to follow those which will insure a still higher quality of service, and to indicate that a system which apparently is quite complex in its interconnections may be readily protected.

The first and most important scheme is to provide a substation with four sources of power in place of the single one previously had. This is obviously quite a large improvement and it is being accomplished without the construction of any additional lines and with only such changes in substation equipment as were inevitable, due to the very rapid growth in the size of the system and connected apparatus.

Referring to the diagram—Kern River Plant No. 1 is at one end of a double circuit 60,000 volt, steel tower transmission line which extends a distance of approximately 175 miles to a substation at Colton. Along this line are substations at Castaic, San Fernando, Macneil, Los Angeles, (L. A. No. 3) Newmark, Puente, Chino, and Colton Cement Works. Each of these stations is important, either in point of load supplied from it, or as being a connecting point for the receipt of power from the main generating station. For example, Castaic, in addition to supplying energy to the surrounding territory, is the terminal station of the lines connecting to the system the 10,000 k.w. plant at Borel. San Fernando supplies power to an important load. L. A. No. 3 is the main distribution station in the City of Los Angeles. Newmark is one of the main connecting points of the 47,000 k.w. steam turbine plant at Long Beach. In fact, each station is of such importance as to demand the fullest use of the facilities already at its disposal. Of equal importance with

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VITAL things still remain to be done

—Victory Loan

serving the stations is the need of maintaining this 175 mile bus free from complete severance at the time a short circuit occurs. Even though there are other lines interconnecting the extremes of the system, yet, under certain conditions, if both of these 60 k.v. lines are opened at one time, a very serious interruption will follow as the system will be split into sections, part probably being overloaded and part underloaded with the usual difficulty in synchronizing them, and the necessity of dropping load to bring up the speed of the overload generators.

The past practice has been to operate these lines in parallel at three points only—namely, L. A. No. 3, Newmark, and Colton. At the other seven points the lines were not paralleled and connection was made to one line only. For example, on the Kern River end there would be two 5000 k.w. generators connected to each line. At Castaic the load would be on one line and the Borel power on the other, the stations at San Fernando and Macneil being connected to one or the other of the two lines. Thus it is seen that these substations were run from one source of energy—one line—and if a short occurred on this line, any place on its 120 miles of length, they went down for the count.

### Confining Trouble to a Section

The protection plan now being installed includes operation of the 60 k.v. lines in parallel at each of the stations enumerated, and the load will be connected to the paralleling points. An equipment "balance" relays so designed that only the defective line section may trip out upon the occurrence of a short, is being installed, and will, upon completion, give these stations energy from each of the four line sections entering the station. Provision is made so that in the event of one line in a section being out for repairs, the remaining line will continue to operate under a suitable scheme of protection. The balanced relay operates upon the theory that, in a grounded Y system, there will be more current flowing in the phase which is grounded than in the similar phase on the parallel line which is ungrounded.

Referring to Figure 2, there are two duplicate parallel lines No. 1 and No. 2 connecting through the stations A, B, and C. Similar "A" phases of the two lines are illustrated. Suppose a ground occurs at the point indicated (and practically all of our shorts are grounds, although a phase to phase short would cause the relays to operate the same as described). At Station A there will be more current flowing in line No. 2 through switch No. 4 than in line No. 1 through switch No. 2. At Station B the same will occur, more current in line No. 2 than in line No. 1 as between Stations A and B. Between Stations B and C the current will be approximately equal in the two lines. From the construction of the relays used, switch No. 4 at Station A and No. 3 at Station B will immediately open and clear the short without dropping any load. The relays are simply In the case where the station is connected to another source of power, as indicated by the dotted lines, the reverse relays must be of the double contact two similar solenoids mounted with their plungers suspended from the ends of a lever similarly to the pans of a balance. The solenoids are energized from bushing type current transformers in the line switches. The current in phase A of line No. 1 being balanced against the current in phase A of line No. 2, etc. It is obvious that with more current flowing in A phase of line No. 2 than in A phase of line No. 1 that the solenoid connected to line No. 2 will exert a stronger pull on its plunger than the other solenoid on its plunger and so cause a deflection of the balance arm closing contacts which energize the trip coil of the respective switch.

Another application of the balanced relay is to place the coils in series with the line as shown in Figure 3. This form of relay is the simplest and cheapest which can be constructed and at the same time gets very good results indeed. The solenoids are placed directly in the line and are wound with wire of ample current carrying capacity. The contacts are closed by the movement of a wooden rod connected to the balance arm and having sufficient length to insulate against the line voltage.

With a short on line No. 1 current will flow as indicated by the arrows and there being more current through coil L than coil M, will result in a deflection of the balance arm toward coil L and so cause the switch No. 1 to trip open. Depending upon the distance of the short from the station shown, the current in coils N and O may be of such relative magnitude that switch No. 4 may also trip open. This may, however, be immediately reclosed and no interruption be caused by its having opened, as switches No. 2 and No. 3 have remained closed. An installation of such series balanced relays has been in successful operation for months and no failure has been experienced except incidental ones caused by improper care.

### Double Line Protection

A scheme of protective relays which changes a station from a single line source of supply to a double line source is illustrated in Figures 4 and 5. In many instances a station is arranged so that it may be connected to either one of two lines and be normally connected to one line with orders to switch from one line to the other should the first line become shorted. This, of course, takes time and causes the station to be dead during the interval. The alternative in the past has been to close the switches to both the supply lines and depend upon the automatic overload relays to trip out the defective line with the result that both lines usually trip out. Figure 4 shows a station wired as indicated.

The switches No. 1, connecting to line 1, and No. 2 connecting to line No. 2 are under the control of reverse power relays so wired that power flowing toward a line will trip the switch connecting to that line. Thus if a short occurs on line No. 1, power will flow from line No. 2 through switches No. 2 and No. 1 to line No. 1 and cause switch No. 1 to open leaving the station connected to the good line. type. That is, they will close one contact when power is flowing in one direction and another when power is flowing in the opposite direction. The con-

nections for this scheme are as in Figure 5 and the relays act so that power flowing in the same direction in both switches will not trip out either, but if power flows in one direction through one switch and the opposite direction in the other, the switch through which the power is flowing to the line will trip out.

**Better Systems of Protection**

The scheme of using reverse power relays for the protection of single lines which conform to the ring system is another variation of the possibility of transforming a substation from one having a single source of energy to one having a double source. This scheme is to install at each station reverse power relays set to close their contacts when power flows as shown by the arrows in Figure 6. The time elements are arranged so that successive relays are set with sufficient intervals between adjacent relays as required for the opening of the switches. In the figure a short circuit is assumed as indicated. The relays having the arrows pointing along the line toward the short will start to close their contacts and at Station C the relay on the line between Station B and C will cause its corresponding switch to open. At Station B the switch on the faulty line section will open and cause the final disconnection of the fault without having allowed any station to be without power. The absolute values of time for which the relays must be set have to be determined by tests of the switches and should also be considered in relation to the setting of other relays on the system. This system of relays is the only one which will accomplish the desired result without the expense of running pilot wires between the stations and is also very inexpensive as compared with the latter method.

The pilot wire system has its application between stations situated within a short distance of each other and when the relatively long minimum time setting required by the reverse power relay scheme would be undesirable. Another application to be made of the pilot wire system is in stations for protection against trouble within the stations. This plan completes any of the plans mentioned, but is not a necessary adjunct to them. As installed the scheme will consist simply of two current transformers in each phase of each line—one where the line enters the station and the other where the line leaves the station. The secondaries are connected in series with an overload relay shunted across them. This relay would only close its contacts when there was a short within the station. For simplicity in construction this relay would act, in a station such as illustrated in Figure 2, to open switch No. 5 and so leave the short on one of the main lines and cause the opening of switches, on that line at the adjacent stations. By this means one of the main lines would remain closed throughout and an extended interruption be avoided.

These few examples of the protection plans of the Southern California Edison Company are given simply as illustrations of what may be accomplished and are not by any means a complete index of this subject. Other schemes using other relays serve their purposes and have been described many times in the past.

# Converting a Steam Plant to Stand-by Operation

BY L. M. KLAUBER

**(The tie-in of the San Diego Consolidated Gas & Electric Company and the Southern California Edison Company at Capistrano necessitated the changing over of the steam plant at San Diego to a stand-by plant with consequent problems in the turbine and boiler rooms, the solution of which has brought out several developments of interest. The paper forms part of the Engineering Committee's Report at the coming Pacific Coast Section N. E. L. A. convention. The author is superintendent of construction with the San Diego company.—The Editor.)**

It is the purpose of this paper to enumerate some of the minor problems which were met in converting a steam-electric generating plant to stand-by operation, following a tie-in with transmission service. While problems such as these are of a secondary character and necessarily differ in individual plants, it is thought that a brief description of what was done in one plant may lead to a discussion and interchange of experiences which should be of value.

The San Diego Consolidated Gas & Electric Company is interconnected to the system of the Southern California Edison Company by a 60 k.v. 50 cycle line 30 miles long, from Katella Substation to San Juan Capistrano, and a 70 k.v. 60 cycle line, 76 miles long, from Capistrano to San Diego. These two lines are connected through a 6250 k.v.a. frequency changer set at Capistrano. At the San Diego end the step-down transformer bank is rated at 6000 k.v.a, 66-12 k.v. Energy was formerly steam-generated at San Diego at 2400 volts, the close-in distribution system being fed directly at this voltage, while the surrounding territory is furnished with energy at 11 k.v. The 2400 volt busses are connected to the 11 k.v. busses through 3 banks of transformers, totaling 6000 k.v.a. Thus it will be seen that there are two transformations interposed between the local generators and the transmission line. The steam equipment at San Diego includes 6194 h.p. of B. & W. water tube boilers; and turbines and engines totaling 11,750 kw., of which the more modern units are 1–2000 kw. and 2–4000 kw. General Electric horizontal sets.

As a stand-by steam plant is operated primarily for the betterment of service, either as to continuity or regulation, there is more latitude in the schedule of operations than exists in a plant producing en-

VIGOR will finish the job

—Victory Loan

ergy. Necessarily, this schedule will be determined by the quality of service received from the transmission line and the degree to which that service must be improved before it is passed on to the customer. Having once determined upon a schedule of operations, it remains to secure the result as safely and economically as possible.

### Times and Conditions of Heavy Load

Prior to the time of the completion of the tie-in with the Edison Company practically all of the energy used by the San Diego Company was steam generated in the San Diego plant. Subsequent to the tie-in the load factor requirements of the contract covering the purchase of energy and the limited capacity of the connecting frequency changer, necessitated the generation of about 15% of the total energy required by the steam. The bulk of this 15% is required over the evening peak; however, during the dry season when the irrigation load is on, some energy must be produced throughout the entire day. Thus it is necessary to operate a turbine for energy-producing purposes each evening, and for a part of the year, during the day load. The first problem in connection with stand-by operation was to decide as to the dependence to be placed on transmission service, and whether sufficient generators should be floated at all times to enable the entire load to be picked up immediately. After due consideration and the development of experience with the hitherto untried transmission line, the following schedule was adopted:

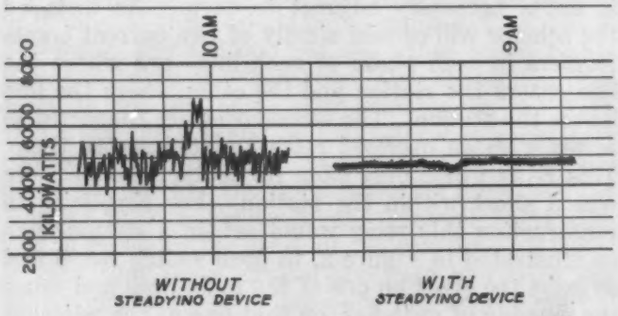



FIGURE 1

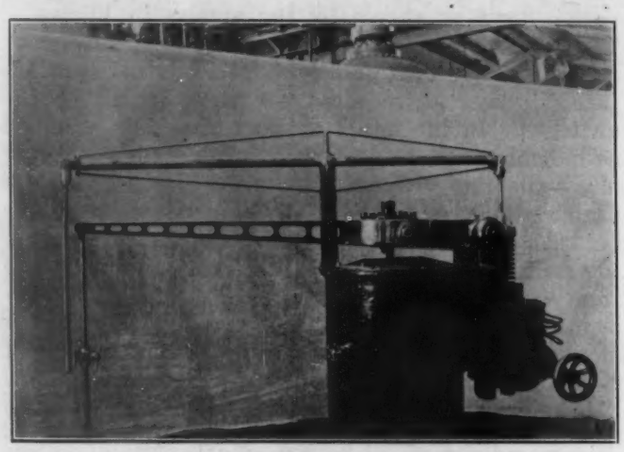
EFFECT OF GOVERNOR STEADYING DEVICE ON WATTMETER CHART

One of the problems encountered was the difficulty of maintaining a proper load division. Load sweeps of from 1000 to 2000 k.w. occurred continuously. This was eventually remedied by the device shown in Fig. 2.

A 4000 kw. turbine capable of carrying 5200 kilowatts is floated daily except between midnight and 6:30 A. M. This permits the immediate assumption of from 85% to 100% of the day load and from 60% to 70% of the night load. On Sundays and holidays no machine is floated until 11:00 A. M. At times of storms or other uncertain line conditions, sufficient units are floated to carry the entire load. The location of the frequency changer at Capistrano gives the San Diego Company an independent voltage control which betters the ordinary transmission service and renders it unnecessary to float a turbine strictly for regulating purposes. However, it is of course true that it is often desirable, entirely aside from consideration of continuity, to float a turbine in order to reduce line loss.

### Failure When the Turbine is Dead

On the whole, the service secured from this schedule of operations is satisfactory, although not so good as that which was rendered before the tie-in. After midnight, when the floating of a turbine appears to be unjustified either for continuity of service, regulation or reduction of line loss, it is necessary to start a turbine from rest to pick up the load in case of failure. By means of close co-operation in the operating force and the installation of the several operating methods described below, we have found that we can put a dead 4000 kilowatt turbine on the line and pick up full load within three minutes after transmission service has failed. This is accomplished by two men in the engine room, the operating engineer and the assistant engineer.



GOVERNOR STEADYING DEVICE

At first a beam was fastened to the turbine frame and clamped to the rod connecting the governor lever to the floating lever of the pilot valve. The load could not be regulated from the switchboard gallery however, and eventually this device was worked out.

In order to interfere as little as possible with the more exacting types of customers, schedules were made showing the order in which feeders should be dropped to carry immediately all the load. At times when the transmission line trips out at Capistrano the transmission line itself is always the first feeder dropped (the line acts as a feeder in carrying the company's north district load through a step down station at Oceanside), since the Edison Company is usually attempting to come in again at once and can thus pick up this part of the load without synchronizing.

### Steadying the Turbine Governors

Some of the mechanical problems of interconnection developed immediately the two systems were tied together. As our operating schedule requires that the transmission line be loaded to the capacity of the frequency changer at all times when the total load exceeds this quantity, it is desired to regulate the load on the turbines very carefully and for long periods over the day load it is necessary that the turbine operate at but a fraction of its rating. No difficulty was experienced in synchronizing and tying the two systems together, but when an attempt was

made to follow the schedule above outlined, it was found impossible to maintain a proper load division, even with the constant attention of the operator. The turbine governors appeared oversensitive and load sweeps of from 1000 to 2000 kilowatts occurred continuously at intervals of less than one minute (Fig. 1). It was seen at once that some steadying device would have to be applied to the turbine governors. The first device experimented with consisted of a beam fastened to the turbine frame at the lower end and clamped at the upper end to the vertical rod connecting the governor lever to the floating lever of the pilot valve. The clamp, faced with leather, was arranged to slip on the connecting rod, the friction of the grip being regulated by adjusting screws. By this means the small movements of the governor were prevented and the load on the turbine steadied. However, this device had the serious disadvantage that load could not be regulated from the switchboard gallery, for if the electrical governor control were operated too large a movement was required before slippage occurred. Consequently it was necessary for the man on the floor to manipulate the load on signal from the operator; a very objectionable condition. This difficulty was entirely obviated by the invention by one of our operating engineers of the load steadying device shown in Fig. 2. This consists essentially of a rigidly trussed beam which parallels the governor beam, the pivot point being anchored to the frame, one end being connected to the base of the synchronizing spring, and the other end being attached to a leather faced clamp which grips the rod connecting the governor beam to the floating lever. The clamp is fitted with proper adjusting screw for varying the friction and also with a release so that it may be quickly disconnected by a half turn of the adjusting screw. This device has given excellent results. The turbine load is easily adjusted by quantities as low as 50 kilowatts with the ordinary governor control from the gallery. The load fluctuations are reduced to a minimum, as shown in Fig. 1. The device does not prevent the turbine from picking up load instantly when the transmission line goes off, and there appears to be no dangerous tendency to overspeed when load is unexpectedly dropped.

### Cooling the Blading

In connection with floating turbines it was of course necessary to provide sufficient steam to cool the blading. In order to determine what quantity would be required and to secure safety of operation, a Bristol recording thermometer was installed on each turbine, the temperature element being inserted in the last diaphragm. The rules of operation require that sufficient steam be admitted to keep the temperature at this point below 250 degrees F. at all times. It was found that on two of the turbines sufficient steam leaked through the controlling valves and packing to keep the temperature below this point. On the third turbine it was necessary to bypass the controlling valves. A ¼ inch pipe was first tried, but this does not pass enough steam to keep the blading below the required temperature when floated for long periods, and it is therefore necessary to admit steam at intervals through the controlling valves. This is done by operation of the governor control, the turbine being operated with a very slight load for about half an hour, which quickly brings the temperature down. It is probable that the size of the by-pass will be increased so that the machine may be floated indefinitely. It might be noted that the leakage of a small quantity of steam past the control valves appears to be a benefit in a stand-by plant, as it enables the starting of a dead turbine quickly with avoidance of expansion difficulties that might otherwise occur.

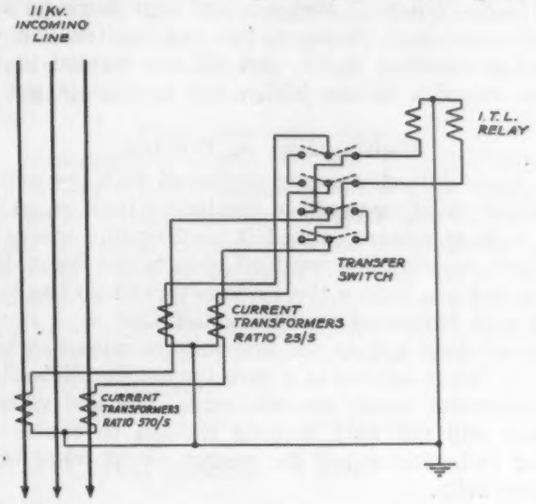



FIGURE 3

TRANSFER SWITCH FOR VARYING RELAY SETTING

Serious disturbance was met with in testing the transmission line, but a double throw transfer switch with two additional current transformers was installed which quickly cut the setting of the relay to a light load position.

### Schedule of Operation

The schedule of operation of turbine auxiliaries in a stand-by plant requires some deviation from the practices of normal operation. As no storage battery was available in this plant it was decided to keep a steam-driven exciter in operation at all times, not only for excitation in case of transmission line failure, but also to furnish emergency plant lighting and energy for the switchboard control circuits. As to the condenser equipment, it appears best to operate with the best possible vacuum on the turbine when floating. Naturally, less circulating water is required at such times, but determinations of the energy required for the operation of the circulating pump with discharge partially closed did not appear to warrant throttling, especially as these pumps are not equipped with electrically operated valves. However, one economy was effected by cross-connecting the circulating pumps of the three turbines. When all turbines are shut down, the steam driven circulating pump on the 2000 kw. turbine is operated to

VIGILANCE is needed

—Victory Loan

circulate water through the condenser of the most economical of the 4000 kw. turbines, which is equipped with a motor-driven circulating pump. Thus, by means of this small pump we are aided in getting a quick start on the large turbine, as the small pump not only keeps the circulating system primed, but furnishes sufficient water so that it is unnecessary to start the pump belonging to the turbine until the unit is brought to speed and carries full load. When all turbines are shut down no auxiliaries are kept running, but the exciter and the small circulating pump, and all are started in the three minutes within which the turbine is put on the line.

### Modifications in Practice

Some difficulty was experienced with the motor-driven circulating pump of the larger turbine, as the low voltage release caused it to drop out whenever the transmission line went off, due to the fluctuation in the voltage before the turbine picked up the load. This was corrected by the installation of a home-made oil dash pot on the low voltage release, which may be recommended as a cure for similar difficulties on important motor installations. The low voltage release will not hold in long enough to cause the motor to be injured if the energy is off more than momentarily.

These turbines are equipped with one of the usual forms of boiler room indicators, which show by rows of colored lamps the number of valves open on each turbine. It was necessary to modify slightly this device so that the first lamp would be lighted, not at the opening of the first valve, but whenever a turbine is operating, so that it thus indicates the floating condition. In connection with the floating of turbines, non-reversing devices were placed on all of the generator watt-hour meters, so that the current consumed by these generators when motoring would not be considered as a deduction from current generated, but would rather be observed in the unaccounted for distribution losses, which would seem to be proper accounting.

### Testing the Transmission Lines

One of the problems which had to be met was in connection with the testing of the transmission line. As the incoming line circuit breaker is ordinarily set to trip at 12,000 kw., it is evident that testing with the switch so set would cause serious disturbance on so small a steam plant. This problem was solved by the installation of a double throw transfer switch as shown in Fig. 3, which by the use of two additional current transformers, quickly cuts the setting of the relay to a light load position approximately 1/5 of its normal setting. This setting is also useful when no energy is being received from the Edison Company, and the transmission line is utilized as a feeder to carry the San Diego Company's northern district.

Naturally, whenever a turbine is operating, either floating or carrying a load, an endeavor is made to reduce line losses by running with the power factor on the transmission line close to unity. As a constant voltage is desired at the receiver end, it is necessary to vary considerably the voltage of the frequency changer generator to compensate for different receiver loads and power factors. The calculated regulation curves of the transmission line were drawn up for a variety of loads and power factors to give the operators at Capistrano Substation an opportunity to regulate to a constant receiver voltage. These regulation curves were found to be considerably in error when checked against actual line operation, but the Edison operators soon became sufficiently familiar with the necessities of the service to come very close to constant voltage at the receiver, either with or without a turbine running.

### Problems of the Boiler Room

The boiler room offered some interesting problems in the quick generation of steam and in stand-by economies. As this plant furnishes steam to an adjacent gas plant and ice plant (although in a far less quantity), the problem was somewhat different from that of the ordinary stand-by plant. Klaxon signals operated from the switchboard gallery were at once installed in the boiler room and at various points in the gas plant at which steam is consumed. By means of one long blast on this signal system, notification is given of the failure of the transmission line and the gas plant steam consumption is instantly reduced to a minimum, which aids materially in securing sufficient steam to pick up load. To aid in starting additional boilers quickly, gas pilots were introduced and proved quite successful. In other boilers which ordinarily burn tar over a lampblack fire (which runs the boiler far under capacity) arrangements were made to introduce oil into the tar burners, this being atomized with compressed air, as it is difficult to get sufficient air through a lampblack fuel bed to burn oil over it. This made it possible to secure full load from a pair of boilers which under normal operation operate at barely one-third of rating.

It was early seen that quick assumption of load transmission line failure was a more difficult problem in the boiler room than in the turbine room, and it was therefore decided to install the Merit Automatic Stoker System on six of the boilers, totaling 3280 h.p. This system has been installed but a short time, but thus far has been successful both in improving the stand-by economy of the plant and the rapidity of steam generation. In order to compensate for pressure drop in the steam lines between boilers and turbines, the control pressure is tapped at the turbine, which gives a much closer regulation. At present with two boilers operating at about 1/3 load on lampblack, furnishing steam for the gas plant, and enough boilers on pilot fire to carry full load, full load will be picked up on a turbine practically instantly, and with only a momentary drop of 5 pounds in steam pressure on the recording pressure chart.

Before the Merit Stoker System was installed considerable judgment was necessary on the part of operators in bringing in a second turbine, since, as the capacity to deliver steam quickly was the limiting factor, if a second turbine were brought in too

quickly, the steam taken by this machine and its auxiliaries at starting would reduce the load which the running turbine might carry.

### Regulation of the Water Supply

After the tie-in it was necessary to give consideration to the question of fresh water economy. Naturally, the balance which had existed under pure steam operation was modified; the amount of fresh water required for make-up water was materially reduced and at the same time the addition of water-cooled step-down transformers added to the quantity required for cooling purposes. In consequence there was a surplus of fresh water in spite of efforts made to cut to a minimum the amount going to the transformers and the turbine bearing cooling coils. After an investigation of various schemes, including the installation of a cooling tower, or the procuring of circulating water from an adjacent gas holder tank, it has been decided to circulate salt water through the turbine bearings. This scheme will shortly be placed in operation and it is believed no deleterious results will follow. An automatic pressure valve will be installed so that upon failure of the salt water supply, fresh water will automatically flow into the coils. A salt water cooled oil cooler is likewise to be installed on one of the turbines to still further reduce the water required in the bearings. If this is successful in conserving oil and water by a reduction in the bearing temperature, the other turbines will be similarly equipped.

Some difficulty was experienced in maintaining a proper balance in the exhaust steam for feed water heating under the new conditions of operation, and it has been necessary to exercise greater care in returning all of the exhaust steam available for this purpose to secure the desired result.

### Plant Efficiency Raised

In conclusion it may be noted that the installation of the various methods and devices described has not only improved continuity of service, but has raised the plant efficiency (when on stand-by service) from about 80 to 105 kw-hr. per barrel of oil. The efficiency of this plant before the tie-in when generating all of the energy required by the company was from 212 to 220 kw-hr. per barrel of oil, depending on the load factor.

# The Use of Pulverized California Coal

BY CHAS. H. DELANY

**(The high price of fuel oil and the available supply of lignite coals in the West combine to interest western power men in the use of pulverized coal. The question of its economical employment as a substitute for fuel oil is here discussed from the standpoint of initial costs and comparative operating expense. The author is steam power plant specialist for the Pacific Gas & Electric Company and the paper is one of the group presented by the Engineering Committee for the coming Pacific Coast Section N. E. L. A. convention.—The Editor.)**

Among the advantages of burning coal in pulverized form, the one that stands out above all others is the fact that no matter how poor the coal, it can be burned in pulverized form with good efficiency. This fact makes the use of pulverized coal especially attractive for California coals, which are low grade lignite. With high grade coals such as are obtained in the Eastern States, the development of stokers has made it possible to secure excellent boiler efficiency. There has always however been great difficulty in obtaining good efficiency with low grade bituminous coals and lignites. These coals having high ash content and high percentage of volatile matter are difficult to burn efficiently due to the difficulty in bringing air in contact with all particles of the combustible. This is due to the fact that the ash surrounding the particles of coal keeps the air away from the latter resulting in a considerable portion of the fuel becoming mixed with ashes. Besides this, the volatile matter does not thoroughly mix with the air so that the combustion of the gases is incomplete unless a large amount of excess air is admitted, this resulting in poor gas analysis.

When coal is used in pulverized form it is ground down to such a size that 95% will pass through a 100 mesh and 85% through a 200 mesh screen. These particles are so small that air surrounds every particle of coal, making it impossible for any particle to reach the ash pit without being burned. This mixture of air and combustible continues in the combustion chamber so that as soon as the volatile matter is distilled off from the coal, it finds itself in contact with the air necessary for its combustion. The result of this is the ash is absolutely free from combustible matter and a gas analysis showing high $CO_2$ with very little excess air.

### Coal Fields in California

There are four coal fields in California from which coal has been produced in commercial quantities, although the production has been reduced to little or nothing since the advent of fuel oil. The present scarcity and high price of oil are reviving interest in these coal fields. They are:

The Ione Coal Field, between Ione and Carbondale in Amador County.

Mount Diablo Coal Field near Pittsburg, Contra Costa County, in which the Black Diamond Mine is located.

Priest Valley Coal Field near the Junction of Fresno, San Benito, and Monterey Counties in which the Stone Canyon Mine is located.

The Corral Hollow Coal Field in Alameda County in which the Tesla Mine is located.

Coal has also been found to a considerable extent in Mendocino, Shasta, Siskiyou and Trinity Counties and there are indications of its existence in ten other counties. In none of these however has there been any commercial production. The follow-

VICTORY was their contribution

—Victory Loan

ing gives approximate analysis of coal obtained from the four principal fields enumerated above:

| | Ione | Mount Diablo | Stone Canyon | Tesla |
|---|---|---|---|---|
| Moisture | 22.44 | 7.9 | 5.2 | 8.0 |
| Volatile Matter | 43.37 | 41.6 | 46.9 | 51.1 |
| Fixed Carbon | 20.41 | 37.4 | 39.6 | 33.8 |
| Ash | 14.73 | 13.1 | 8.3 | 7.1 |
| Sulphur | 2.98 | 6.03 | 4 | 2.4 |
| B.t.u. per lb. (as received) | 9,322 | 10,010 | 12,300 | 10,230 |
| B.t.u. per lb. Dry | 12,016 | 10,880 | 13,000 | 11,126 |

It will be noted from these analyses that in all cases the volatile matter is in excess of the fixed carbon. This relation immediately classifies these coals as lignites and consequently the same difficulty may be expected in burning them efficiently as is common to all lignites, so that the advantages of using them in pulverized form are apparent.

### Value Compared With Oil

By a study of the foregoing analyses it is possible to determine approximately the value of coal compared with oil. The analyses show a considerable percentage of moisture, and before the coal can be pulverized this moisture must be driven off in a drier. Taking the analysis of Mount Diablo coal for example, one ton of coal containing 2000 lbs. with a moisture content of 7.9% would require 30 lbs. of coal in the drier to drive out the moisture. Besides this the weight of moisture itself amounting to 158 lbs. must be deducted, so that the net weight dry coal delivered to the boilers from one ton of coal as received would be 1812 lbs. As each pound of dry coal has a heating value of 10,880 B.t.u., the total heat units obtained from a ton of coal would be $10,880 \times 1812 = 19,700,000$ B.t.u.

No tests have been made of California coal burned in pulverized form, but tests made in Seattle on coal of similar quality show efficiencies running from 70 to 77%. Assuming a boiler efficiency of 75%, the heat absorbed by the boiler per ton of coal would be 75% of $19,700,000 = 14,790,000$ B.t.u. A barrel of fuel oil containing 336 lbs., each pound having a heating value of 18,300 B.t.u. would have a total heating value of 6,150,000 B.t.u. Many tests of oil burning boilers have shown efficiencies as high as 80%. Taking this figure the heat absorbed by the boiler per barrel of oil will be 80% of 6,150,000 $= 4,920,000$ B.t.u. Since this is almost one third of 14,790,000, it is obvious that one ton of coal is equivalent to three barrels of oil.

To determine the price at which the coal could be used to correspond with a given price of oil, it is necessary to allow for the expense of drying, pulverizing and handling the coal. The equipment required for this purpose including the building, bunkers, driers, pulverizing mills, feeders, burners, conveyors, and elevators, costs approximately the same as the boilers themselves. In other words a boiler plant complete with pulverized coal equipment would cost twice as much as the same boiler plant equipped for oil burning. This high cost of equipment required for pulverizing coal means a considerable annual expense due to fixed charges alone. Besides the fixed charges, other items entering into the annual cost are labor, power and repairs, and it is found that the total expense involved in the use of pulverized coal amounts to very nearly $1.00 per ton. This is on the assumption that the plant is operated at full load. If the plant is operated at light load the fixed charges and labor costs per ton increase so that the total costs may run as high as $1.50 per ton.

Since three barrels of oil are equivalent to one ton of coal, it is a simple matter to determine the comparative values of the two fuels. In the following table the price of coal is given corresponding to price of oil from $.60 up to $2.00 per barrel. Two columns are given for the prices of coal, one being the equivalent price of pulverized coal delivered to the boilers, the other being the equivalent price of raw coal delivered to the plant, allowing $1.00 per ton for the cost of handling and pulverizing.

| Price of Oil per Barrel | Price of Pulverized Coal Delivered to Boilers per ton of raw coal | Price of Raw Coal Delivered to Plant per ton |
|---|---|---|
| $ .60 | $1.80 | $ .80 |
| .80 | 2.40 | 1.40 |
| 1.00 | 3.00 | 2.00 |
| 1.20 | 3.60 | 2.60 |
| 1.40 | 4.20 | 3.20 |
| 1.60 | 4.80 | 3.80 |
| 1.80 | 5.40 | 4.40 |
| 2.00 | 6.00 | 5.00 |

This table is favorable to coal owing to the fact that it is assumed that the plant would operate at full load. If the plant is to operate at a light load factor, proper allowance must be made for the additional cost per ton of pulverizing. The actual price at which coal can be delivered to a plant is indefinite and depends on the location of the plant, cost of coal production, freight rates, etc.

The above table will enable a determination to be made as to the relative values of the two fuels in any particular case in which the price of coal is known. For coal to compete with oil at $1.60 per barrel it must be delivered at the plant for $3.80 per ton or less, but in order to compete with oil at $1.00 per barrel it must be delivered for $2.00 per ton. While the former figure might be reached, the latter figure does not seem possible, and it is obvious that the question as to whether it would pay to change from oil burning to coal burning depends largely on what the future prices of oil are likely to be.

### The Plant at the Mine

The possibility of building a plant at the Coal Mine and transmitting the electric energy to its point of use, has many attractive features. A special investigation would be required in each case. Some of the questions involved would be:

The water supply at the mine, the distance the power would have to be transmitted, involving the cost of transmission line, the transmission losses, etc. Some of the mines in the State have practically no water supply and in some cases it may be found best to locate the plant at some point between the mine and the point at which the power is to be used. Another possibility is the building of the drying and pulverizing plant at the mine and shipping pulverized coal to large and small consumers. This is now being done on a limited scale in Seattle, and it has been found feasible to ship pulverized coal in tank cars. This will enable a single pulverizing plant to operate at high load factor and to supply coal to a number of diversified existing plants. In this con-

nection it may be said that the storage of pulverized coal is a problem still to be solved, as spontaneous combustion is liable to occur if the pulverized coal is allowed to stand for more than five to fifteen days. Where continuity of service is essential in a pulverized coal plant, it is desirable to have the plant equipped with oil burners as a standby. This is because the handling of the coal involves so many elevators and conveyors, and the breaking down of one link is liable to shut down the whole plant.

### Still in Experimental Stage

In conclusion it may be said that the burning of pulverized coal under boilers is still in the experimental stage. It has been proved, however, that it is possible to burn it, and it is probable that within a few years the design of equipment will be standardized and simplified so that its cost will not exceed the cost of stoker equipment.

Pulverized coal has the advantage that it is possible to obtain a higher efficiency with it than is usually obtained with stokers, especially where low grade coals and lignites are burned. It has the further advantage that coal of any kind can be burned, even sludge and mine refuse containing as high as 35% of ash.

Little trouble may be anticipated due to dust explosions provided the pulverized coal is confined. Any leak in a pipe conveying pulverized coal should be stopped, and as much care should be taken to prevent leaks as would be taken in the case of gas.

One objectionable feature of a pulverized coal plant is the dust that is discharged both from the driers and from the smoke stacks. On this account it would not be advisable to install a pulverized coal plant in any locality in which dust would be objectionable, such as a residence district in a city.

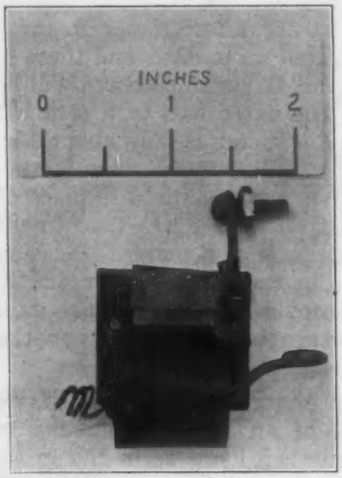
California coal was burned successfully in pulverized form some twenty years ago in a small plant in San Francisco. Its use on a large scale is simply a question of relative prices of coal and oil. The California Coal fields, while not extensive, are an asset that will prove of great value as the scarcity of fuel oil increases.

# Increasing Revenue by the Watthour Meter

BY OTTO A. KNOPP

**(Although the induction watthour meter is both accurate and reliable, it often lags far behind the desired standard under the heavy overloads to which it is submitted. A curve straightener which permits the accurate recording of heavy loads by a small meter offers a solution of the difficulty. The author is with the Distribution Department of the Pacific Gas & Electric Company. The paper forms part of the convention report of the Engineering Committee, Pacific Coast Section, N. E. L. A.—The Editor.)**

The modern Induction Watthour Meter is a remarkable engineering development. From the standpoint of range, accuracy and reliability, it is unsurpassed by any other electrical instrument, and yet the severe requirements of the service for which it is built overtax its capabilities. It can be termed the "cash register" of the electrical companies' revenue; therefore, its accuracy and the sustenance of its accuracy under all conditions of service is of paramount importance. The present day electric service requires that a meter measure accurately a very small and very large energy flow. This is particularly true in all small services, and also in many large services.




**The Curve Straightener**

**A very small series transformer which diverts about one-fifth of the current from the current winding of the meter.—It weighs only 2 oz. and can be mounted inside the standard 5 ampere meter. —Fig. 1.**

### The Advent of Appliances Changes Problem

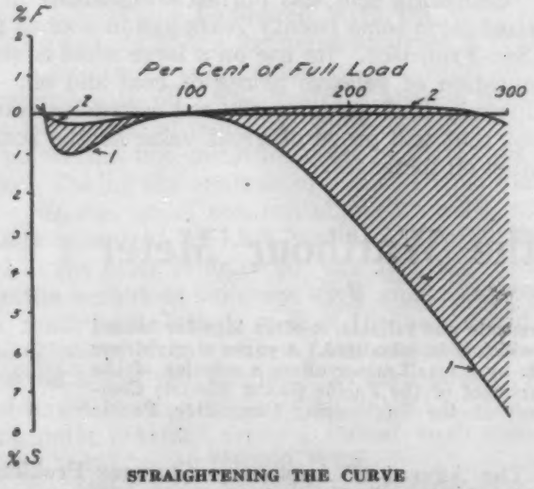
Labor conditions have made the cost of frequent tests and inspections of the multitude of small capacity meters prohibitive. It has, therefore, become more imperative than in the past to select the meter as small as possible for the service to obtain the highest possible torque and thus insure accuracy on light loads. The five ampere meter had for that reason been the standard in most electric service companies until, in recent years, a new factor entered into the consideration for the selection of the proper size of the meter. This factor is the very extensive use of all kinds of electric appliances such as five and ten ampere electric heaters, flatirons, percolators, toasters, etc., placed into service without the knowledge of the electric service companies. Such appliances, together with lights, cause the five ampere meter to operate on 10, 12 and even 15 amperes. The meter manufacturer has partly taken care of this condition by giving the five ampere meter an extra large overload capacity. A modern five ampere meter will carry continuously over twenty amperes, but will do so only at a greatly reduced speed. Carrying twenty amperes, the under registration is in the neighborhood of 15% to 20%; at 15 amperes around 6% to 8%; at 10 amperes 2% to 3%. This under

VAGUE patriotism pays no bills

—Victory Loan

registration and consequent loss in revenue has caused a number of western power companies to go to the expense of using the 10 ampere meter as their standard, reasoning that by increasing the accuracy on loads of 10 amperes and over, they are gaining more than the interest on the extra investment* in a larger meter plus the additional losses caused by under registration of the 10 ampere meter due to its torque being one-half that of the 5 ampere meter on the same loads.

For several years it has remained a matter of argument, which loss in revenue to the power companies is greater, the short hour overload loss, due to the drop in the accuracy curve of the 5 ampere meter, or the loss due to under registration of the




STRAIGHTENING THE CURVE

Curve No. 1 is an average typical load curve of 3 different makes of induction watthour meters—Curve No. 2, an average load curve of the induction watthour meter with the curve straightener applied. The shaded portion represents the percentage load registration gained.—Fig. 2.

10 ampere meter on the long hour light loads from night lamps, hall lamps, porch lamps, etc., but in all cases it has been conceded that the loss is appreciable; so appreciable that some companies were willing to invest 25% more in the same number of meters to regain only the difference between the two losses. It is very obvious that the greatest gain could be secured if both losses could be avoided. This can be accomplished by retaining the 5 ampere meter with its higher torque as the standard and improving its performance so as to get accurate registration up to possible 15 amperes.

### A Curve Straightener

Investigations conducted in the laboratory of the Pacific Gas & Electric Company by the writer have led to the development of a so-called "Curve Straightener," a separate little device weighing only 2 ounces, which can be mounted inside the standard 5 ampere meter, and a modification of this device which can be connected externally to the meter, giving such meters a practically straight curve. This is accomplished by the application to the meter of a very small series transformer, shown in Fig. 1, which diverts about 1/5 of the current in the circuit from the current winding of the meter. The exact amount of current diverted depends on the amount of current in the circuit, and it has been found that the series transformer can be so designed that its characteristic compensates for the diversion of the meter characteristics from a straight line, beginning at the smallest loads and extending to loads of nearly 300% of normal. In Fig. 2 are shown 2 curves. Curve No. 1 is an average typical load curve of three different makes of the Induction Watthour meters; Curve No. 2 is an average typical load curve of the Induction Watthour meter with the curve straightener applied. The shaded area represents the percentage load registration gained by using the curve straightener.

It is interesting to note that the gain is not confined only to the heavy loads, but that on the medium and small loads a gain is recorded, which gain is appreciable, due to the fact that such loads are usually carried over longer periods of time.

### Tests Prove Satisfactory

Service tests have been conducted with a number of "straight line meters" by placing each one in series with the regular meter on a consumer's premises. Residences and stores were selected without knowledge of the character of the load and each pair of meters was adjusted so that, operated in series, both meters recorded exactly alike at 10% and 100% of full load, as shown in the accompanying diagram. With the exception of one installation where the gain was only .65% with the smallest bill of about $1.50 per month, the gain was over one per cent in others. The maximum gain was 1.5%. This maximum gain was recorded in a small tailoring shop, where a few lights were used practically all day and an electric sad iron several times a day; the bill amounting to about $8.00 per month.

Only five of such straight line meter installations have been investigated up to date, and there is good reason to believe that larger differences will be found in many cases. The extra cost of a straight line meter over the regular meter is only about 12c, according to estimates by leading meter manufacturers, if the former meter is manufactured in place of the latter. The interest on this extra investment amounts to only 5c per year per meter. If each 5 ampere meter brings in the average, say $20.00 per year, and one per cent is gained, the net gain would be 19.5c, or a return of about 160% on the extra investment.

Looking at it from another standpoint,—if we assume the net balance of an electric company is 20% of the gross revenue, an increase in the gross revenue by 1% would mean a 5% increase in the net balance.

Another advantage gained by using a straight line meter is found in the elimination of all disputes over what is the accuracy of the regular induction watthour meter operating under a widely varying load. Many of the eastern power companies have gone to great expense in the testing and computing to arrive at a fair average value; all on account of the diversion of the meter accuracy curve from the straight line.

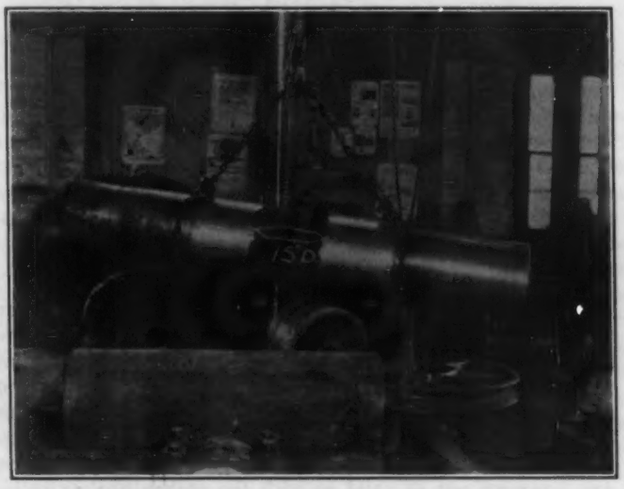
*A 10 ampere meter costs, net, about $1.50 more than the 5 ampere meter.

# The Electric Welding Load

BY JOHN HOOD

**(A knowledge of the requirements of electric welding aids materially in intelligently handling this load. The various classes of welding and their special features are here briefly surveyed by the author who is industrial engineer with the San Francisco office of the General Electric Company. This paper forms a portion of the Pacific Coast Section N. E. L. A. Engineering Committee's Report for the coming convention.—The Editor.)**

Few engineering and scientific developments have made, in so short a time, strides comparable with those made in electric welding. Under the stress of war—a war so vitally dependent on engineering materials—an impetus such as would have been difficult to obtain through any other medium was given to every means of increasing production of the equipment so necessary at that time. Among the foremost materials in point of necessity were steel and iron in practically all of their forms, and every agency which possessed known or even likely possibilities of increasing the output of



15 inches diameter, nickel-steel shaft reclaimed through building by arc welding after being mis-machined. Value of the shaft, $800. Cost of reclamation work, $50.

metal products, and ferrous metal products in particular, was brought into service and its possibilities developed through intensive research and test.

### War Need for Electric Welding

Naturally electric welding in its various forms came to the front by leaps and bounds, permitting as it does, in a very extensive section of the industries using ferrous metals, of carrying out more economically, expeditiously, and in general more perfectly than by other methods the effective joining of heavy steel parts; the reclaiming of broken, defective, or wrongly machined castings and forgings practically regardless of form or size; the repairing of fractures and building up of worn parts in heavy pieces of equipment without the necessity for disassembling and removing such parts to the shop; the elimination of time and expense involved in laying out, drilling, reaming, riveting and calking of both heavy and light plates for practically all types of structures; the making of water tight and oil tight seams at a lower cost, with greater rapidity, and with greater assurance of success than by other methods; the joining of ferrous to many non-ferrous as well as a considerable number of non-ferrous to non-ferrous metals and alloys. Many amplifications of the foregoing processes, too numerous to mention in a paper of this kind, are in practical and constant use today but the possible fields of application have, in reality, been merely scratched.

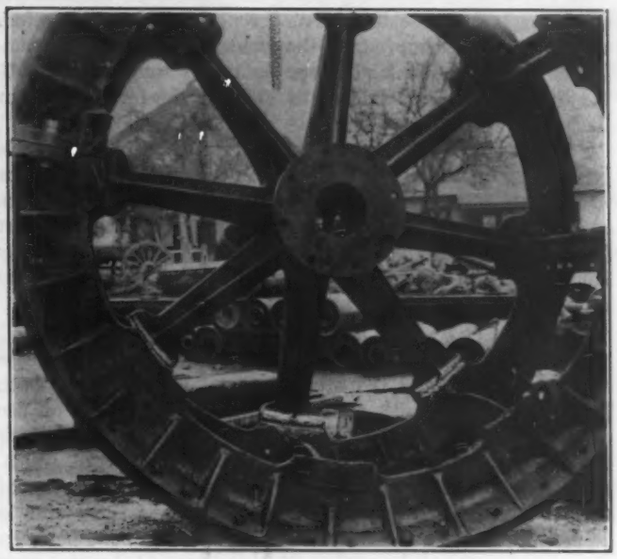
### The Field of Application

Very naturally the greater part of the development of the use of electric welding has been in connection with the shipbuilding industry, that industry being one which has been under constant pressure to increase output during the war and which at the same time, involved the use of enormous tonnage of steel together with the necessity for water tightness and oil tightness of much of the structure of each vessel.

However, other industries have not been blind to the advantages derived and electric welding has found a welcome place in automobile factories, railroad shops, boiler ships, foundries, sheet metal working establishments, machine ships and in various businesses producing metal products varying from the size of a pin head to pieces weighing several tons.

### Two Types of Electric Welding

Practically all electric welding may be classed under two general headings, resistance welding and arc welding. The former is closely allied with the old process of "smith welding" or "impact welding" which consists primarily in



Arc welding arms to rim of 24,000 lb. wheel.—Entire structure cast steel. Gas welding previously tried did not prove satisfactory for this job.

heating the two pieces of wrought iron or steel to be welded to a temperature at which the metals are plastic, bringing the surfaces together and applying pressure through hammering or its equivalent, resulting in a union of the two parts. A flux such as borax is used to assist in fusing any oxide in the joint, the hammering causing the oxide to be extruded after fusion.

Resistance welding has all of the advantages of smith welding and, in addition, possesses certain points of superiority over the older process in that the heat, in concentrated form, is applied at the exact location where the weld is to be made and any oxide in the joint is melted during the fusion of the metals and is thus easily extruded by the application of pressure without the necessity of using a flux.

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VACATION after this one

—Victory Loan

Various forms of resistance welding are in common use and are ordinarily designated as butt, spot, button, ridge, line, seam, point, tie or bridge welding, deriving the various designations either from the shape of the parts at the weld, as in the case of point welding or button welding, or from the process of applying the weld as in the cast of butt welding, spot welding and line welding.

Due to the fact that the metal in the joint at the time of fusion is not exposed to the air, and therefore to oxidation, nor is it heated to so high a temperature as in arc welding, many metals, among them aluminum, antimony, bismuth, cobalt, copper, manganese and nickel, as well as most bronzes and brasses, can be welded together and in many cases to each other.

Alternating current is always used for resistance welding, being readily obtainable in the form of high currents at low voltages, special transformers in practically all cases forming part of the welding equipment. This class of welding requires single phase currents of from 50 amperes to 70,000 amperes at from 4 to 20 volts or from 2. kva. to 1400 kva., the area of the weld and thickness of material handled determining the current necessary. The power factor of this type of welder is usually between 30% and 40% on 50 and 60 cycle circuits and between 60% to 75% on 25 cycle circuits.

### Load Factor in Resistance Welding

The load factor* of resistance welding varies greatly with the work in hand, depending largely on the accessibility of the parts to be welded and on the portability of the welder where it must be moved, as the welder is inherently a cumbersome affair. The load factor ordinarily ranges from 80% for the smallest line welders to 25% for the largest spot or butt welding units.

This type of welder turns work out rapidly, is suitable for use by relatively unskilled labor and will, therefore, be used principally where labor is high and rapid duplicate work at low cost is required. It is not in general adapted to short jobs involving relatively few operations, nor for work away from sources of considerable power, as it is heavy, bulky and requires relatively large amounts of power.

### Arc Welding

Arc welding falls into two general groups, one using a carbon electrode and the other a metal electrode and both being susceptible, with certain practical limitations, of use on either direct current or alternating current circuits. Both depend upon the same general basis for successful welds, namely the heating to a welding temperature, by means of an electric arc, of the metal to be welded and the metal to be added, in such a manner as to form a fusion bond between the parent and added metals. This new or added metal may be used as a bond uniting the two pieces of parent metal or merely in building up or adding to a single piece of parent metal.

Carbon arc welding is, in practically all cases, done by direct current. The fact that heat in any arc is largely concentrated at the positive electrode is taken advantage of by connecting the positive side of the circuit to the piece to be welded and the negative to the carbon electrode. The heat necessary to fuse the metal is, therefore, concentrated to a large extent at the point where most needed. In addition to this, no carbon is introduced from the electrode into the weld as would be done if the current were reversed in polarity. In using a carbon arc on an alternating current circuit, the carbon as a whole becomes very hot, therefore being uncomfortable to the operator, and the work loses the benefit of the concentration of heat at the weld obtained when connected on a direct current circuit as above mentioned.

*The load factor used throughout this paper is the hourly load factor. Load factors for longer periods depend to such an extent on the class of work being handled as to be too variable to be of significance in a general statement.

Four principal classes of work are usually handled by this process:

1st: The most important and incidentally the simplest, being the cutting or burning off of iron or steel parts such as heavy gates on castings and for reducing scrap metal to sizes suitable for convenient handling. This is in reality not welding but burning of metal and is used where the resulting irregular or ragged surfaces, which are unavoidable in this process, are not objectionable. Wherever a relatively smooth, clean-cut surface is desired, the oxy-acetylene flame is superior to arc cutting.

2nd: The welding of heavy pieces of iron or steel by using very heavy currents.

3rd: The filling the holes and cracks in steel, iron, brass and bronze castings.

4th: The welding of brass and bronze.

In all but the first class, rods of material of the same general type as the parent metal are fused into the section to be welded.

The current required for the carbon arc is usually from 100 to 1000 amperes with approximately 50 volts at the arc. However, the most equipments of this type depend upon a series resistance to limit the short circuit current at the time of striking the arc, the power required may be of any value between two and twelve times that absorbed in the arc, depending upon the supply voltage. On electric railroad track work where the power is taken from 500 or 600 volt circuits, the energy at the arc is sometimes as low as 8% or 10% of the total power consumed in the outfit. In general, however, the power used, in other than extreme cases such as the one just mentioned, would be from 2 to 4 times the arc power. The load factor on carbon arc work ranges from 40 to 75% on welding or practically uninterrupted cutting work.

### Metal Electrode Welding

Metal electrode welding is very similar to carbon arc work but in place of feeding a rod of new metal into an arc formed by other agencies, the metal to be used into the joint is used as an electrode, melting off in small particles and fusing into the parent metal, the same scheme of connections being used and polarities observed as in the case of the carbon process. The objections to alternating current operation are, however, not so valid as with the carbon arc, as satisfactory work can be done with an alternating current arc when skilfully handled and when overhead work is not necessary.

Metal electrode welding covers by far the larger part of the arc welding done at the present time and is thoroughly successful. Considerable difference in opinion still exists regarding the efficacy of direct current vs. alternating current; the relative merits of coated, uncoated, dipped or covered electrodes; and the best chemical composition of electrodes for this class of work, but in spite of all differences of opinion, satisfactory welds are being made with almost any combination of these variables within reason. Good welds have even been made when using uncoated fence wire as an electrode. I do not mean to imply that these variables are unimportant and that careful investigation to determine which can be used to best advantage is not justified, but merely wish to point out that at worst, the work can be successfully done with relatively unsuitable materials when the work is handled by a skillful operator. Obviously, the use of processes and materials which are more nearly perfectly adapted to the work is to be encouraged to the utmost.

The metal electrode process is applicable to all steel and wrought iron welding, can be used on brasses, bronzes and malleable iron to quite an extent, and to a very limited extent on special cast iron jobs. The current required is usually between 20 and 200 amperes, depending upon the thickness of the parts to be welded and upon the diameter of electrode used, most of the work being done between 80 and 150 amperes with from 15 to 25 volts at the arc and using 3/32 to 3/16 inch diameter electrodes. Higher arc voltages are apt to cause excessive oxidation of the welding metal and the

inclusion of iron oxide in the weld is detrimental to its strength and soundness. When a series resistance is used to limit the short circuit current at the time of striking the arc, about 2 to 4 times the power above indicated must be supplied due to the waste of energy in the grids.

### Load Factor of Metal Electrode Welding

Several machines in the shape of motor generator sets having characteristics which automatically take care of the voltage under varying current conditions, so as to maintain approximately constant current in the arc, are now on the market and increase the efficiency approximately 25% over the grid type of equipment. The load factor of metal electrode welding on fairly accessible work and at small and medium current values is approximately 65% to 75%. On very heavy currents the load factor falls off a few per cent due to the necessity for inserting new electrodes more frequently than with smaller currents. Ordinarily a 3/16 in. diameter electrode 12 in. long, will last approximately 2 minutes when handling a current of 150 amperes. An increase to 200 amps. reduces the life of the electrode to about 70 seconds.

### Bettering the Load Factor

The above consumptions at the arc apply to either direct current or alternating current equipment but the kva. input when operating on alternate current is materially above the kilowatt input as may be appreciated from the fact that transformers for alternating current arc welding have an inherent reactance of approximately 90%. The power factor of such an equipment is usually between 15 and 25% lagging, which, unless corrected by a near-by condenser, imposes a rather unattractive load on distribution lines and generating equipment. In regard to the effect of low power factor in limiting output of generating equipment the following instance is cited. It is well known that one of the chief limitations in securing output of alternators is in the construction and design of the revolving field. The excitation of the average standard alternating current generator at 80% power factor and full kva. output is approximately double the no load excitation and about 250% for 20% power factor. In addition to thus limiting the output of generating equipment, line regulation would be seriously impaired and fixed changes on equipment and standby losses would become a serious burden. This, however, can be taken care of by installing either condensers of proper capacity at the welders or motor generator sets each having a motor suitable for the commercial circuit supplying the power and driving a single phase generator of proper voltage and characteristics for handling the arc. In most cases the former will prove the more economical and in general the more satisfactory of the two methods.

### Enlarging the Field

Proved economies and facility of operation will continue to enlarge the scope of electric welding in its various forms. Electric welding has reached a point where no fundamental reason remains for doubting its effectiveness and usefulness. On all but the lightest work, and on cast iron, it is superior to any other process of welding from the standpoint of cost of work and is comparable in every way with the best product of other processes. A typical case is shown by a comparison in which a carefully kept series of costs in a railroad shop where a given group of jobs had cost $7839 when welded by processes other than electric was done, and identical jobs were electrically welded at a cost of $1154, a saving of approximately 85%. The reclamation of material which would go to the scrap pile if welding were not resorted to, shows economies which are even more striking when the possible scrap value plus the cost of welding is considered in relation to the purchase price of new parts. A saving of several hundred per cent on such items is not unusual on heavy work.

The significance of such performances is becoming appreciated to a greater and greater extent and can not but build up the welding load. A knowledge of the requirements of the various classes of this work, coupled with a realization of the possibilities of usefulness of each class, will aid materially in having electric welding intelligently applied and the equipment properly served.

# Kilowatt Hours per Barrel of Oil. What Does It Mean?

BY S. J. LISBERGER

**(The value of comparative statements is based upon an assumed parity of the terms used. Some of the inaccuracies involved in the use of the term "kw-hr. per bbl. of fuel oil" are here pointed out and an alternative basis of comparison suggested. The author is chief engineer for the San Francisco district with the Pacific Gas & Electric Company and the paper is one of the group presented by the Engineering Committee of the Pacific Coast Section N. E. L. A.—The Editor.)**

During the past twelve months the unfavorable weather conditions, due to the small rainfall, have caused a serious shortage on the several hydro-electric systems on the Pacific Coast, as a result of which the operating companies have been forced to generate a very large amount of electric energy from steam plants, which plants burn oil for fuel. The increased use of fuel oil has, of course, increased the cost of production of electric energy.

Managers and operating engineers on the several systems where this condition has prevailed, have been comparing notes, as it were, on the so-called efficiency, or what might better be termed the result of operation of their respective steam plants. It has been the custom to talk of this result or efficiency of oil burning, in terms of "kw-hr. per barrel of oil." This term "kw-hr. per barrel of oil" is very likely to be misleading; to mean one thing in one plant and something different in another plant. It will be the purpose of this paper to discuss in short form some of the errors that are introduced when making comparisons on the basis of "kw-hr. per barrel of oil," and from this discussion it will be readily seen that the cost per kw-hr. for electric energy generated by steam will vary very widely, even in the same plant.

The thoughts expressed herein are probably quite familiar to many operating men, but I feel that they have not been taken into consideration when discussing the results of steam plant operation. It is the further purpose of this paper to endeavor to clarify the situation for future discussions.

**VERIFY your citizenship**

**—Victory Loan**

The conditions of operation mentioned herein are such as are, or may be, met in the operation of steam plants in connection with the hydro-electric systems on the Pacific Coast. This should be borne in mind, as it has a very definite result in the plant operation.

### Energy Generated or Delivered

The first question that arises is: "What is actually included in kw-hr.? Does it include all of the kw-hr. generated in the plant, or does it include only a part, or does it mean something else? For example: Assume a station having three turbines generating energy at 11,000 volts; in this station there are approximately 500 kw. of steam driven exciters. The auxiliaries in the station are partly steam driven and partly electric driven, some of the electric drive being by a.c. motors and others being by d.c. motors, such d.c. equipment being fed from the exciter system. If the energy generated is metered at the terminals of the turbines just before it reaches the main station bus-bar, and if all the a.c. supply to the station is in turn metered at the bus-bar so that proper deduction for use in the plant will be recorded, you will get a certain record or result; but if, on the other hand, you add to the kw-hr. generated by the turbines that energy generated by the exciters, and if you do not make proper record and deduction for uses of the d.c. in the station, so as to make it comparable with the a.c. metering, another figure will result. This statement may seem to be rather out of place, but in talking with many operating men, and upon being asked: "How many kw-hr. per barrel of oil do you generate at your plant?" I am invariably given figures anywhere from 180-240, but with no qualifications as to how the result is obtained. In other words, does the term kw-hr. mean kw-hr. generated or does it mean kw-hr. delivered? There may be a very considerable difference between the two figures, depending upon plant conditions.

I say this difference may be considerable. This will depend on how the auxiliaries in the plant are driven, that is, whether steam or electric, and furthermore, how large the electric auxiliaries may be, and where the meter records are taken.

### Operation of Auxiliaries Affects Economy

The operation of these electric auxiliaries may vitally affect the economy of the station. This will be brought out more in detail later on. It is furthermore of prime importance to have a common basis of understanding as to what kw-hr. means. After all, it does not make very much difference, for the purpose of comparison, whether you take the kw-hr. generated or the kw-hr. delivered, if you will only recognize a common standard, or if you will qualify your term so that it may be reduced to what might be termed a common standard.

The next question that arises is: "How does your plant operate in connection with the hydro-electric system?" It may operate in one of three ways, each of which will vitally affect the economies of the results obtained.

1. The steam plant may deliver a definite block of energy to the hydro-electric system through predetermined hours of the day, month or year, as the case may be, supplying no energy other than to the hydro-electric system. The question whether the station regulates the system voltage and speed will have a bearing on the results.
2. The plant may be operated in such a way that it supplies a certain locality and at the same time delivers a certain amount of energy to the hydro-electric system, and in the meantime acting as a regulating station for the general hydro-electric system, to which it is connected.
3. The plant may perform a combination service, namely, delivering energy to the transmission system and to the immediate territory in the vicinity in which the plant is located, during a part of the day, and during the other part of the day it may be operating as a standby plant, floating on the hydro-electric system, ready to deliver at an instant's notice a definite amount of load to the territory in which the plant is located, should the hydro-electric supply fail, there being no interruption of service to the city in which the steam plant is located. This combination service may vary radically within the 24 hour period. The question as to how the plant regulates the system voltage and speed will also have a bearing on the economy of operation.

### Practice in San Francisco Station

Let me ilustrate by speaking of a plant and the system in connection with which it operates, with which we are all more or less familiar. The plant is Station "A" San Francisco, on the system of the Pacific Gas and Electric Company. In the station there are three turbines, with a boiler room capacity, let us say, sufficient to supply 40,000 kw. at the present time. The San Francisco city load, let us assume, has a daily average of 28,000 to 32,000 kw. and a peak depending on the seasons of somewhere between 36,000 and 44,000 kw. A tie exists on the south with the hydro-electric system, through which there can be delivered energy to the extent of 14,000 kw. A tie exists by the Golden Gate cables on the north, through which there can be delivered 10,000 kw. Let us apply the conditions of 1, 2 and 3 above to this plant.

1. The conditions of No. 1 would hardly ever be applicable to this system, inasmuch as the steam plant is located in San Francisco and is used entirely under the conditions of No. 2 and No. 3. This condition, however, might apply to any one of the several plants of the Southern California Edison Company or the Great Western Power Company.
2. There are certain seasons of the year when Station "A" delivers to the San Francisco local system about 30,000 kw. and delivers its excess capacity to the transmission system to the extent of 4-6-8000 kw., depending upon the needs of the system.

   As the pumping plant supplying salt water to the condensing system is electrically driven and as the units are quite large, the kw-hr. net, delivered, will vary considerably with the amount of load being delivered to the transmission system, as certain pumps will be necessary for an operation, say, up to 30,000 kw., but above this load other pumps will have to be put on the line to supply the circulating water, and if, say 35,000 kw. of energy must be delivered to the system over a long period of time the quantity of energy used for pumping water may be considerably larger in proportion than, say, the load on 30,000 kw., and herein comes the question whether you are speaking of kw-hr. generated or delivered, and herein also enters the question as to how the plant is operated.

   Furthermore, depending upon conditions prevailing on the hydro-electric system, the plant may deliver

energy to the hydro-electric system on the south end and receive hydro-electric energy on the north end, one or more turbines being operated in parallel with the north end receiving energy, this depending upon load conditions. The turbines may be called upon to regulate for speed and voltage control.

3. During the season when water conditions are very good, the transmission system will deliver to the San Francisco system as high as 20,000 kw. As there are two routes over which this energy may be delivered, and as it is not feasible to parallel through these two routes, it necessitates the operation of two turbines on one side of the system and one turbine on the other side of the system, on the assumption that the steam station shall supply 12,000 kw. to the system, in the meantime running in parallel with the San Francisco system, and ready on an instant's notice to deliver to the city system the amount of energy that the transmission system is supplying, should the hydro-electric system fail.

   This is accomplished by carrying one fire under the sufficient number of boilers that would be required to carry the total load, so that when the transmission fails the other burners under the same boilers (three burners per boiler) have merely to be turned on and by proper regulation in the boiler room, the load can be handled, and is handled, without interruption.

These above three conditions are given in order to explain the conditions of operation that may pertain. With these various conditions it will not be difficult to understand why kw-hr. per barrel of oil should vary very widely, and have no real meaning when used for comparative results, even on the same system.

Electric companies have for a long time realized that the consumer who had a good load factor was a very much more profitable consumer than one who used power only over the peak or only at rare intervals. This is evidence by the fact that low rates per kw-hr. are given to consumers with a good load factor, while considerably higher rates apply to those consumers to whom standby service must be supplied. I think the justice of this type of rate is quite evident to all public utility men and to the consumer.

Before we endeavor to compare the results of our several systems we should compare the load factors under which the plants are operated. It is almost unnecessary to state that great variations in the daily load factor do not tend toward economic results, particularly where the variations are very marked in a short period of time, and furthermore the heat balance of the plant is always difficult to maintain under the best conditions of operation. Furthermore, it is difficult to obtain the best results from the operating force, where conditions are changing radically during short periods of time, even granted that there be sufficient diversity in the types of auxiliaries to make allowance for the heat balance.

I think from the foregoing you will recognize that the term "kw-hr. per barrel of oil" has very little meaning unless the conditions under which the plant operates are very definitely specified, and therefore few comparisons may be made between different plants, or as stated before, it is very difficult to make comparisons even in the same plant, where conditions of operation change radically from year to year.

It is therefore very difficult to conceive what "kw-hr. per barrel of oil" should be under these varying conditions, because the changes can be so radical and so different.

In order to visualize just what is taking place in the plant we have made use of certain curves. (Owing to delay in their receipt, these could not be shown here, but will be found elsewhere in this issue on page 399.) From these curves we can get a much better idea of how the plant is being operated than by using the terms "kw-hr. per barrel of oil."

From these curves it can be seen how the results vary through the month.

These curves are extremely interesting, since if a continual record is plotted you can determine by month or by year the amount of oil required for a standby. If a record of this kind will be kept for a sufficient period of time, and if you may assume the conditions under which the plant will operate, you can pre-determine the amount of oil which will be necessary for any assumed period of operation. Furthermore, the curve makes a very simple record for yearly comparisons.

In conclusion, I desire to emphasize the purpose for which this paper was written, namely, to show that the term "kw-hr. per barrel of oil" means nothing unless the conditions under which the plant operates are most properly qualified, and (2) to point out to the operating man and the managers that the cost of energy where fuel oil is burned varies very largely with the operating conditions of the plant and with the load factor under which the plant is operated. Furthermore, it is very difficult to make comparisons, particularly under our Western conditions. It is far easier for the coal burning plants, operating under conditions more fixed than ours, to make comparisons of their energy costs for coal or oil burning plants.

The steam plant of the Western coast has a very definite function to perform and in performing this function it is often necessary to render service rather than efficiency, particularly when expressed in terms of "kw-hr. per barrel of oil."

## UNDERGROUND DAYLIGHT

A recent item in the London Electrical Review describes a very interesting example of illumination employing a concealed source of light, in the daylight window-lighting effect at the Cafe Cairo, Dublin. The room is entirely underground with entire absence of daylight. For the lighting 100-watt half-watt type Mazda lamps are used, equipped with X-ray reflectors placed outside the windows.

The light is thrown upon white millboard, from which it is reflected through the arctic glass of the dummy windows, producing the effect of morning sunshine which is very pleasant. Hangling lanterns are used at midnight in the event of dances, when the daylight effect is not desired.

VALIDATE those promises

—Victory Loan

# The Proper Training of the Sales Personnel

BY LEE H. NEWBERT

**(The elements to be considered in the selection and training of the sales force of any business with special reference to the conditions and present practice of the electric utility company. The paper, which forms part of the Commercial Section Report to the Pacific Coast Section N. E. L. A., was prepared by the manager of the Commercial Department of the Pacific Gas & Electric Company in collaboration with J. F. Pollard of the Sierra & San Francisco Power Company and I. W. Alexander of the San Joaquin Light & Power Corporation.—The Editor.)**

In every organization manufacturing a salesable product the Sales Department is of the greatest importance, for no manufactory can exist unless a demand is created for its products. The degree of success attained is directly traceable to the department which disposes of this product or commodity.

Contemporary business history furnishes many examples to prove this assertion. For instance, the National Cash Register Company's tremendous success is due to a sales force carefully selected for natural fitness and ability and then educated and developed to the highest degree of efficiency.

### The Public Utility's Sales Department

It may be said "True, but this cannot apply to the electric utility because that is selling mainly a service and not a product, and it is a service with which the public can not dispense. Why, therefore, should salesmen be necessary to a utility?" It has been amply proven that no theory could be farther from the truth. It might almost be said that the utility of today is as much a purchaser as a seller,—as much a buyer of good will to be paid for in services as it is a seller of kilowatt hours. No utility that is not on harmonious terms with the population it serves can be considered successful when judged either by the standard of proper functioning as a public servant or from a financial standpoint.

The principle of commission regulation of utilities has become an established institution. As constituted in this state, the regulatory body has absolute control over the rates on which the utility depends for its life-blood and for its financial success. When this present regime was first established, more or less doubt was expressed as to what the result would be. The more skeptical advanced the theory that the utilities would suffer. It has developed, however, that the members and staff of a progressive Railroad Commission and the forward-looking men of the public generally are realizing more and more that the interests of the public and those of the utilities serving it are one and the same. The services of the Utility Salesman in fostering and developing this idea are thus indispensable and quite as much of his time must be devoted to this duty as to the actual selling of electrical energy and appliances.

We therefore reiterate, that in the electric utility organization more than in that of any other manufacturing business, the salesman as **the** point of contact is not only important,—he is absolutely essential. It is, therefore, particularly appropriate that we should at this time direct our thought and attention to the question of "The Proper Training of the Sales Personnel."

### The Type to Select

Before we can proceed, however, to the consideration of the salesman's training, it is necessary to give careful thought to the type of person which we would select for induction into this important branch of our organization.

Whenever possible the prospective salesman should be selected from the ranks of the company because of his good record for faithful service and loyalty,—two very essential characteristics. Unquestionable integrity and honesty are, however, the first requirements, because the company's reputation with the public will depend very largely on that of its salesmen who quite frequently, in the eyes of the public, are the company, and it has been well said that an employee who will steal for you will also steal from you. Our candidate should also be neat in his personal dress and appearance and, to use a time-worn phrase, "Be able to meet people." By this we do not necessarily mean that he must spend a lot of the company's money, or his own, for drinks for the prospective customer, or lose it to him in a game of poker, but that he should have an easy manner of address, be unfailingly polite on all occasions, have complete control of his temper and make friends easily. In short, he must be a gentleman in the true sense of the word.

The electrical industry is inherently technical and it will be a great advantage if our prospect has at least some education in technical matters. This, however, is not absolutely essential and can be dispensed with if he has a good general education and more than average intelligence.

### Women as Salesmen

Women as sales-people can be used to excellent advantage. As canvassers and demonstrators in the sale of household appliances it is obvious that a woman can command more respect and attention in talking of the advantages in lightening housework and cooking by the use of such appliances, and the proper methods of handling them to get the best results. She will be listened to more attentively and what she has to say will be accepted with better grace than would be the case should a man attempt to tell the housewife the same facts.

The sales-room also offers a field for the profitable employment of women. The woman who shows that she understands electricity and its application is somewhat of a novelty. She, therefore, will command the admiration of the feminine trade. Her knowledge and well-prepared selling talk will be more or less awe-inspiring and will have a great influence in closing the sale. The appearance of a

bright, cheerful, neatly dressed young lady in a fixture or appliance store will increase its attractiveness and make it more inviting to the prospective woman purchaser, nor will her presence fail to impress the masculine trade favorably.

Having selected the most likely candidates with due regard to their native qualifications, let us next turn our attention to those qualities which it will be necessary to develop by our proposed course of training so as to best fit our sales-people for the work of selling our particular product.

### Satisfactory Service

The meat of the nut of salesmanship is satisfactory service. In the ordinary routine of our lives, when it becomes necessary to buy a pair of shoes, if the clerk is obliging and courteous and makes certain that you leave the store in a pair of shoes that fully meet your requirements, the next time it becomes necessary for you to purchase shoes you will make an endeavor to buy from this same clerk. The matter of the proper fit of a pair of shoes is of much importance to every one of us; so with the farmer and the selection of his pumping plant, or the housewife with the choice of her electric stove or washing machine. The article in all cases must fit the requirements. If anything goes wrong with these articles of vital necessity, the effectiveness of the day's operation on the farm or in the home is greatly decreased, resulting in complaint and dissatisfaction. If your new shoes pinch you or a poorly made heel drops off, what is the first thought that comes to your mind? Why, the salesman who sold them to you, of course, and the desire to return the unsatisfactory shoe to him for proper repair. Therefore, it is reasonable to believe that the housewife or the farmer will have the same thoughts as you do under similar conditions. If the purchaser does get in touch with the salesman and he in turn sends the customer away again satisfied, he will have accomplished only that which is expected of him in his relations with the public.

### Familiar With Company's Policies

It is essential that our salesman should be thoroughly schooled in the policies of the company and in the workings of its every department. He must be familiar with conditions and policies in the financial and executive department so that he may be able to direct his efforts to the additional load where the necessary extensions of service will be of such a kind as can be met from available finances. He must be thoroughly familiar with the policies of the credit department so that he can advise a customer what must be done to establish credit and be able to explain why. All utilities in this state are operating under general rules established by the Railroad Commission governing this question, and the public is already quite generally informed. A careful and strict adherence to these rules, together with such information as the salesman can obtain in regard to a prospective customer's credit, will be of material aid to the credit department in obviating the necessity for sueing delinquents, because it will minimize the number of delinquents.

A knowledge of the procedure in the engineering and construction department will make it possible for the salesman to see to it that the extensions which are most urgent will be taken care of in advance of those which may have been signed up at an earlier date, but which are not so pressing. It will, also, enable him to advise the customer as to what kind of an installation and equipment will pass the inspection department.

Familiarity with the routine of the despatcher's office will enable him to prepare the power consumers for interruptions and do whatever may be possible to minimize the inconvenience occasioned thereby.

Co-operation between the sales force and every other branch of the organization must be as perfect as obtainable, for the salesman must never make a promise unless he knows that the other departments can and will make good, or vice versa, the other departments must never fail in a promise once made by the sales force. In this way only will confidence be established and maintained.

### Knowledge of Wares Essential

In addition to the closest possible contact and co-operation with their own organization our salesman must be thoroughly familiar with every detail connected with the appliance or service which he is delegated to sell.

If he is selling appliances he should know of what they are made, how they are made, whether or not they can be repaired, and if so, what the cost will be, how they compare with others of a similar kind in prices and efficiency and should be able to give a good reason for price difference. He should never "knock" a competitor or his goods. If his competitor's product has points of superiority he should gracefully admit it, at the same time truthfully maintaining and explaining the meritorious points of his own product. Truth and frankness pay in the long run. In time the customer will surely find out if he has been deceived, and if so, confidence in both the salesman and his company will be destroyed.

If a salesman is selling service for agricultural pumping plants he should be familiar with, and be able to discuss various types of pumps, water lifts and many other matters in which the farmer is vitally interested as well as the cost of kilowatt hours and the line extensions.

The tendency of present-day rate-fixing practice is to make a "scientific" rate, full of reference to "power factor," "load factor," "demand factor," "energy charges," "service charges," "customer charges," "demand charges," "minimums," "discounts" and "penalties," most of which are worse than Homeric Greek to the average customer. It, therefore, devolves upon the salesman to thoroughly understand the principles of rate-making and to be

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—Victory Loan

able to pick out the most economical rate for his customer's conditions and to work out the same to his complete satisfaction and understanding, if possible.

### The Question of Training

Having decided on the personnel of our sales force and the broad lines along which they are to be trained, we now come to the main subject in hand, viz., how to train them, and glancing back over the prescribed essentials we must admit we have set out upon a man-sized job. However, it has been done with more or less success and we must therefore not despair at the outset.

First we must offer him a salary commensurate with his position, which you will remember is in the most important department of the organization. We do not ask him to work for a salary that the meter setter would not consider, for we remember that this man is going to make work for the meter setter. We also bear in mind that it will cost something to educate this salesman to a point where he is of real worth to the Company and we realize that the compensation must be such as to attract a competent and aggressive man and keep him loyal.

Among several of the larger Eastern utilities that serve vast populations, the salesman and other representatives who come in contact with the public, have first to pass through a school of instruction in which they are thoroughly equipped with the necessary knowledge and information for their particular lines of work before beginning to sell.

When a prospective salesman has been selected he is schooled in the policies of the company, shown the methods of operation of the different departments and finally drilled in all the matters necessary for a complete understanding of the service or commodity he is expected to sell. When he has successfully passed through this school of instruction he is given the position of a salesman, and not before. His work is carefully watched and if he shows any aptitude for selling, he is persistently encouraged and his record carefully watched. Should he be sent out to sell a line which is new to him, he must again school himself for this work. This, of course, is the ideal way of making salesmen; but to the most of us who are at this time so vitally interested in the proper development of our sales forces, this plan is beyond our reach and we have of necessity to consider more immediate result-producing possibilities.

### N. E. L. A. Courses

Here the National Electric Light Association has come to our aid with a series of most admirable correspondence courses. It offers "Practical Electricity" which is intended to give a knowledge of the necessary fundamental principles (tuition, twelve dollars); "Commercial Engineering," which covers thoroughly and completely the selling end of the industry in all its branches (tuition, fifteen dollars); "Elementary Accounting," covering fully the fundamental principles of bookkeeping and accounting (tuition, sixteen dollars); "Advanced Course in Electric Utility Accounting," including all phases and the best modern practices of our most progressive companies (tuition, sixty-five dollars).

These courses are carefully prepared by specialists and edited by committees composed of men of long experience in the electric utility business. The tuition fees mentioned include all necessary books and special material.

The Commonwealth Edison Company of Chicago has offered to advance the full tuition fee to all employees who desire to take any of these courses, the same to be paid back in small weekly payments and the Company further agrees to refund one-half of the tuition fee to those who satisfactorily complete any of the courses while in its employ. Here is an excellent opportunity and an example, especially to those smaller companies who can not afford an elaborate individual training school of their own.

### Care in Selection of Employees

No two companies find their needs and possibilities exactly the same. Whatever training method we adopt, we can say without reservation that no matter what the size and extent of our organization, it must have a good, healthy morale if it is to function properly. In other words, we must have a "happy family." One organization represented here today has an employes' welfare department, through which all applications for employment pass. Not only is care taken to place an applicant in a position for which he appears to be qualified, but the progress of his work in this position is watched, and if he is "falling down" an endeavor is made to discover the cause of his failure, whether through inefficiency, indifference or domestic trouble, and an effort is made to adjust it. When an applicant is given a position, he is personally introduced to every person in the department, and all with whom he is to come in contact in the performance of his duties. He is accorded a hearty welcome and thus impressed with his importance such as he would not acquire were he permitted to shift for himself in becoming amalgamated with the organization. The good effect on the morale of organization through this simple practice can be readily imagined.

### A Folder of Essential Information

Another utility concern with a representative on this committee pursues a very useful and effective means of impressing upon the newly employed salesman several delicate truths, that might cause embarrassment were the effect made to get the idea across during conversation. He is given a little folder containing four or five typewritten sheets of instructions and a statement of the policy of the company which affords the opportunity to say in an impersonal way something to the new employee about what is expected of him in the matter of his dress and personal appearance, and also of the spirit he is expected to display in the performance of his work. This idea might well be followed by us all. We should have our code of selling ethics, or a ten commandments of selling, which should be continually before our selling forces. Salesmen should be compelled to conduct themselves during working

hours according to this code and if they have the interest of their work at heart, they will. Otherwise they should not be in the organization.

To our knowledge, a certain large construction company maintains a book of rules so complete that there is scarcely a conceivable contingency that is not covered.

Such a book in our business would of course have its limitations, but it is possible to prepare at least a set of general rules for the salesman's guidance and to furnish answers to a list of the more probable questions the salesman will be asked. There is, after all, only one best way to handle each different situation, and if the salesman is schooled in several hypothetical cases his intelligence can be depended upon to select the best course of procedure along the lines of his instruction.

Such rules and suggestions can be amplified and kept up to date by the establishment of a mimeographed loose-leaf bulletin recording all changes in rules or policy.. This bulletin could easily be made of great educational value by publishing an occasional sales-talk of special merit, or a talk by the general manager or heads of departments. In this manner the best thoughts of the organization may be collected for the use of present and future employees.

As an example, when the so-called emergency increases in electric rates were recently effected, this matter should have been fully covered by a bulletin that the salesman could have read and from which he could have gathered data so that he could state with conviction that loan capital, labor, fuel, taxes and material had all advanced and he could have told the consumer in just what proportion. Being so well prepared with facts and figures there could be no excuse for his making some such weak statement as "Well, I don't know why they do it I'm sure, but it's a rule of the company," etc. While a little knowledge may be "a dangerous thing" none at all is fatal.

Of course our salesmen should be instructed under no circumstances to start an argument or even waste time with a theorist, but when challenged by Mr. Average Citizen he should be sufficiently informed to protect the company and preserve his dignity. The salesman who cannot answer reasonable questions makes himself contemptible in the eyes of the customer and surely does his company an injury.

### Spreading Propaganda

Our man should be taught to be a propagandist. He should be able, through the instructions he is receiving day by day to defend intelligently the policy of his company.

He should know that the utility business is being placed on a service at cost basis and that any citizen with a grievance can readily get a hearing. He should be told that public service companies are owned by hundreds of thousands of investors. He should know what the Railroad Commission does and can do. All this will result in a better knowledge of the business by the employee and if he is a good propagandist the result will be also a better understanding between the consumer and the company.

When there are enough salesmen employed to warrant its success, there is nothing to stimulate interest like get-together meetings and conventions. Here there can be an interchanging of ideas that will result in nothing but benefit.

### Other Employees as Well

And not only should a training of this kind be given the sales personnel, but to every employee who in any manner comes in contact with the public. To show how easily this can be accomplished and the effectiveness of the effort, a district agent of one of our principal power companies holds weekly meetings on a regular evening at which all the members of his organization are present, including linemen and groundmen. The meetings are not lengthy but they are full of snap. After a series of talks on the organization, the methods of operation, policy and such general matters, the agent goes into the detail of his own organization, such as the necessity for good and legible penmanship, the proper filling out of reports, the duty of the employee to treat company property with the same consideration that he would personal property, the consideration of the problems of the different departments and how one department can help the other for the more efficient operation of the district to the advantage of its general record.

These weekly meetings are decidedly popular and the increased efficiency of the district is very noticeable. The agent at all times will provide ice cream or other refreshments. The result of the plan is cooperation and a general understanding that cannot be obtained by years of personal effort.

### The Basis for Enthusiasm

The sales forces should be brought into closer contact with the managing heads of our utilities. The salesman should be made to feel the responsibility resting upon him and he cannot do so unless he feels that he has the confidence of his chiefs. It is necessary to inject a little enthusiasm into a sales force from time to time, and what better method is there than a talk with the "big boss." As a matter of fact it is essential that the salesman know the hobbies and the dreams of the "big boss." This would give him an understanding of present policies not clear to him, but for which, considered in connection with future operations and plans, the necessity will become apparent. Regular meetings of sales forces and branch managers offer an excellent method of arousing enthusiasm.

To quote Dr. Lee Galloway, Chairman of the National Commercial Gas Association:

"A ginger talk may carry a salesman through a day's selling campaign, but the enthusiasm that is to carry him through a whole year and keep him cheerful day after day when rebuffs are frequent and business hard to pull can come only through the proper assimilation of information and knowledge

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**VERY patriotic, weren't you? Well, are you?**

**—Victory Loan**

pertaining to his job which, turning first into confidence and then into enthusiasm, builds within the tissues a storage battery of sales energy and loyalty for his firm."

Much information can be gained from the trade journals and the salesman should be encouraged to read them regularly. Also there are many valuable books on personal efficiency, scientific management, psychology and salesmanship.

### Learning as Well as Teaching

Some method should be taken to ascertain the amount of knowledge our salesman is acquiring. Probably the most simple way to do this is to assign him the task of preparing an article to be read before the other men, possibly offering a prize for the best paper.

There is much to be taught our men of which no mention has been made and there are many things of which, perhaps, we have never thought that they may be able to teach us. We have but barely touched upon the many ways in which a salesman can be of great value to his company outside of the strict limits of signing contracts.

Time and space will not permit us to enlarge upon his other activities which, however, are equally important, such as mingling in public affairs and interesting himself in charitable, business, church and the many other organizations which make up the life of the community.

He can also make himself invaluable in adjusting complaints and disputes in regard to bills or collections, or any trouble connected with the company's service, more readily than could the employee of some other department who has not established the friendly relations with the customer that to the salesman are essential to getting business as well as to retain it.

# How Can the Electrical Industry Assist the Architect?

BY J. O. CASE

**(A co-operation which will benefit the architect, the electrical industry and the consumer should be welcomed by all parties. Practical suggestions are here offered as to what is needed to remedy the present situation and what can be done next year. The author is associated with the local manager of the General Electric Company of Los Angeles. The paper is one of the Commercial Section's contributions to the coming convention.—The Editor.)**

He who makes two sockets grow where one grew before is, according to the present-day version, just as much a benefactor as the agriculturist who increases the production of blades of grass. A great deal has been accomplished along this line by the various electrical interests, but the surface has only been scratched. Perhaps the most fertile field and the one which has been most neglected is in co-operative work between the various branches of the electrical industry and the architects. It is true some of the manufacturers have done considerable missionary work and some of the contractor-dealers' associations have also accomplished excellent results. But so far a well-defined, aggressive campaign by all branches of the industry has not been attempted. Such a campaign could well be conducted to the great benefit of all parties concerned—the consumer, the architect, central station, manufacturer, jobber and contractor-dealer.

### How Will the Consumer Benefit?

Any plan such as this must necessarily fail unless its first essential is to safeguard and benefit the consumer. He is the most vital factor in any such campaign. His interest is paramount and can best be served when he gets the greatest return on his investment in electrical wiring and appliances. This is possible only when he gets a well-planned job, adequate to all of his needs, present and future, properly installed, at a fair price. The specification that does not include all of the outlets necessary, such as baseboard receptacles and outlets for appliances, does not permit the owner to get the proper return on his investment and necessitates expensive extras after the job is completed.

It is a well-known fact that an adequately wired house commands a more ready sale and is much more easily rented than one which is not so provided. If a business house is being planned the far-sighted landlord will find it greatly to his advantage to have the future wants of any possible tenant anticipated in the layout of the electrical work.

It is a rather surprising fact, and one probably not appreciated by either architect or owner, that the electrical work in a commercial structure or residence averages only about 2¼% of the total cost of construction. It is equally true that changes or additions made after completion of the job average 300% higher in cost than if done as original work. Notwithstanding the fact that for a slightly increased appropriation for the electrical work a thoroughly complete job could be had, the architect will not consent to add anything outside the ordinary run of work without approval of the owner. In apartment houses the electrical conveniences are largely gauged by the rental the owner expects to obtain from his prospective tenants. In buildings to be occupied by owners the electrical layout is largely dictated by the amount the owner is willing to spend. The latter is really the turning point of the whole proposition. In the case of other products which enter into the building the manufacturers have done a large amount of consumer advertising, thereby creating a demand on the part of the public which must be satisfied by the architect. One of our big problems is, therefore, the education of consumers so that they will demand electrical conveniences.

The standards of lighting have changed materially in the past few years. Increased street and

store illumination have raised the requirements of residence lighting. In order to best serve his client the architect must now provide for sufficient lighting properly placed, not only in the home but in the industrial establishment. New rules are now being formulated by the State Industrial Accident Commission regulating industrial lighting along the lines of the requirements in New York and other States. Certain standards of illumination per square foot are prescribed for industrial establishments, depending upon their needs. These same standards will naturally find their way into the homes and co-operation between the electrical industry and the architects will safeguard the owner against expensive alterations.

The consumer knows very little of the safety requirements of the Accident Commission from the standpoint of the electric power installation. A proper study of industrial problems by all parties interested will insure a speedy solution of the difficulties and the development of adequate protective measures without prohibitive cost to the consumer. It is indeed a shock to the owner to find that an installation, perhaps just completed, does not comply with the Accident Commission's requirements and must be changed at considerable expense to him. The proposed new requirement of emergency lights placed ahead of the main switch in industrial plants is an illustration of the saving to the owner in having his needs known and provided for at the outset.

With the new conditions imposed by war, the general unrest of labor and the tendency toward Bolshevism, we are necessarily becoming more and more self-sustaining. We must do more of our own work ourselves. The advertisement for a servant is not productive of the results it once was. This condition will no doubt be more or less permanent and we must recognize the changed order of things. The electric washing machine, vacuum cleaner and similar appliances that lighten the labors of the housewife are going to become extremely popular. A great number of women who have filled the places of men in the service are now returning to domestic life. These women, accustomed to labor-saving devices in their industrial occupations are going to demand the same sort of efficient methods in their home life.

It is the obligation of the architect to provide for this new condition and the job is big enough to require the combined efforts of all the electrical fraternity in conjunction with the architect.

Aside from the strictly utilitarian need of the present, there is nothing more conducive to happiness in the home than the plentiful use of electricity. In our business life we see to it that the most up-to-date methods and appliances are taken advantage of—why not show our wives the same consideration by helping them do their work efficiently. A forceful illustration of this occurred recently in a small near-by town. The salesman for an aggressive contractor-dealer was endeavoring to interest a woman in an electric washing machine. She was convinced of its advantages but the salesman would have to see her husband about it. The interview with the latter was not going at all well—the salesman was abused in every way and finally ordered from the place. "I will go" replied the salesman, "but before doing so I am going to tell you what a selfish proposition you really are. Over by the barn I see you have an expensive tractor. Your food-chopper and cream-separator are both motor operated. That hay-stacker saves you a lot of work. Now why shouldn't you give a little consideration to lightening the work your wife is compelled to do. Good day." Not ten days afterward this same farmer called at the dealer's store and apologized for his actions and said the remarks of the salesman had set him thinking—and he bought the washing machine.

The first requirement for the use of electrical appliances is, of course, an adequately wired home. The difference in cost between the ordinary wiring job and the one which is complete in all details is so small that it will cut little figure in the ultimate cost of the residence. New buildings can be taken care of by the plan which is suggested. There remain, however, the great number of houses which are at present inadequately wired. But this is a condition which is largely up to the contractor-dealer to correct and is one of his opportunities, which has been covered in another paper.

### The Architect Will Also Benefit

All business of the present day is striving to give service. The architect must show his client this same service.

The building restriction during the war has resulted in congestion of living conditions which will greatly stimulate building operations just as soon as the labor and material markets will justify. Now is the proper time for the architects and the electrical industry to improve the opportunity thus offered to see to it that the new residences and business buildings about to be erected are adequately equipped from an electrical standpoint. Far too many specifications now consist about of the following: "The wiring of this building shall be done with rubber-covered wire and shall pass inspection." One does not have to look far for examples of poor specification work. Perhaps in an office-building the question of the switchboard has been handled as an afterthought, with the result that insufficient space has been provided, perhaps considerable additional conduit work is necessary, etc. A specific illustration of this was seen recently in a large building in which the switchboard, upon which were mounted open switches, was placed about three feet directly in front of the elevator. Not content with this trap the two feet back of the board had been well filled with steam pipes. A more dangerous location, front and rear, could not have been found. Needless to say this owner is having an expensive job in complying with the Accident Commission's requirements

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OLUNTEER — don't be forced

—Victory Loan

which should have been avoided. The isolated plant in a hotel building, for instance, which has not been dsigned by a competent engineer, usually offers the most glaring illustration of poor engineering practice to say the least.

In planning illumination the average architect is weak because he is not acquainted with the fundamental principles involved. He will usually welcome assistance on this, however, because in the average structure the resultant illumination, plus the switchboard, wall switches and receptacles is about all the owner sees for the money expended. Where certain standards of illumination are required by law as in the new proposed code, the architect will be compelled to work on a more scientific basis than he has been accustomed to.

The question of heavy wattage appliances is one which must be given consideration in the wiring layout. For residence work the possible installation of ranges, water-heaters, air-heaters or any device consuming more than 660 watts should be provided for. In industrial plants the list includes furnaces, tempering-baths, drying-ovens, etc.

The Electrical Utilization Safety Orders and the National Electric Code are closed books to the architect, and he, therefore, welcomes a disinterested party who is willing to keep him from making errors in the application of these rules. When one says the National Electric Code it must also be taken into consideration that all of the larger cities have made amendments thereto and these are to be considered when talking to the architect. He is also, as a rule, glad to hear of new applications of electricity, particularly anything which will tend to reduce the cost of maintenance in the building. In the planning of a residence he is usually willing to take up with the owner the question of proper provision for electrical appliances, but the final decision invariably rests with the owner.

This is the day of specialization. Developments are coming so fast in the electrical field that we are busy keeping up with them. The field of the architect is one of the broadest in the engineering profession and he cannot hope to keep up-to-date on the details. How often have we gone into a home or business establishment and upon seeing a poorly planned job, whether from the standpoint of plumbing, electrical work or what not, inquired, "Who was the architect?" He is immediately blamed for all the shortcomings of the building. For the sake of his own reputation the archtiect should welcome a concerted move on the part of the electrical industry to help him. He would thereby be assured of complete and reliable information on the subject of the electrical requirements and the assistance he would be given would insure his client of a thorough and adequate installation.

**The Central Station Can Better Serve Its Consumers**

It might appear that in advocating the growth of two sockets the central stations are actuated by a purely selfish motive, which is not the case. The central stations advocated the use of lamps of higher efficiency when this policy made a distinct reduction in their revenues. The public has been benefited thereby as it always is by any plan which makes possible a more general use of electricity.

A proper co-ordination of all interests will result in proper wire sizes being used, hence enabling the central station to render the best possible service. The proper location of meters from the standpoint of accessibility will affect the central station's cost of service—and rates are based upon cost. The contractor-dealer having installed a creditable job should see to it that his customer is provided with the necessary electrical appliances to round out a satisfactory installation. It naturally follows that more lighting and appliances will be used on a well-appointed installation, resulting in increased revenue plus a better satisfied customer. The absence of a socket in the place where one should have been installed is a source of constant inconvenience to the consumer and a perpetual loss of revenue to the central station.

**The Manufacturer's Obligation**

The rapid development along electrical lines makes it necessary from the consumer's standpoint that steps be taken which will insure to him the benefits to be obtained from the use of such developments. The plumbing interests have seen to it that the need for their wares is recognized and the result is that when an appropriation must be cut down on a building the plumbing specification does not suffer—while it is almost a by-word with the architect that the electrical work can be cut.

The work which has been done by the electrical manufacturers in conjunction with the architects has proven conclusively that such work is of great benefit to all concerned. A case in mind is that of a rural high-school building in which the electrical work as originally laid out amounted to about $700.00. By a careful study of the needs on the part of a competent engineer the appropriation was increased to $2100.00, which gave the school nothing but what was actually needed and created satisfaction and pride to the entire school district in a well-equipped domestic science department.

**The Jobber's Part**

Any move which will benefit the electrical industry, as this one certainly will, cannot help benefiting the electrical jobber. It will enable him to render a better service to his customers. With the merchandising of appliances done largely by the dealers instead of by the central stations, as in the past, it will become more the function of the electrical jobber to push the sale of such wares by assisting the dealer in his merchandising efforts.

Many excellent wiring devices are now being put on the market by the various manufacturers; devices which are unknown to the average contractor and which will materially assist the appliance game. Educational work must be done by the jobber in acquainting his trade with the particular advantages of these devices.

**The Contractor-Dealer**

Should the contractor-dealer in his zeal to land the job install but one socket where there should be two, both he and the owner will suffer. Present-day

conditions will require, sooner or later, the two sockets. If he installs them at the outset he has done a good job and it is hoped has received a fair price. If he did not install them both it is very likely the young hopeful of the family will purchase a few feet of lamp cord and a coil of tape and make the installation himself with all of its attendant hazards and the contractor-dealer will have lost revenue and the owner suffers by not having his needs properly cared for.

The average contractor does not have sufficient time to do much in the way of specification writing. His work would be greatly facilitated if he had a clear and concise layout of the job he is figuring. There would not be the chance for misunderstandings that are possible with an incomplete specification and the result would be a smaller item for contingencies in the bid—a bid which would insure the owner that he was getting a satisfactory installation, and which would also give the contractor a fair profit.

The various regulations which have been enacted, such as the safety orders and the electric codes are for the benefit and protection of the owner and the contractor should endeavor to comply with these requirements instead of, as is too often the case, try to find ways of evading them.

With a large number of central stations discontinuing the free renewal of lamps the opportunity of the dealer is great. He must be alive to his opportunities and do his part in increasing the use of electricity if he hopes to profit by the additional sale of lamps brought about by this condition.

One manufacturer of electric washing machines has announced that his production has reached the point of turning out a machine every three minutes. The wide-awake dealer is going to reap a big reward from the sale of these machines—and it will be a much easier task to land the prospect for a washing machine or other electrical appliances in a home where the question of additional wiring does not have to be raised.

A closer co-operation between the contractor and the architect will smooth out many of the points of friction that now exist. If he will deal with the architect in questions arising such as changing the location of outlets and switches instead of taking the matter up with the building contractor the owner's interests will be better protected. The architect is the owner's agent and will see to his interests, while the building contractor has no such incentive and is too apt to authorize changes which will mean a saving to him at the expense of the owner's convenience.

The following extracts from a report presented at a recent meeting of the Minnesota State Association of Electrical Contractors and Dealers shows that this matter is being given general consideration and offers specific recommendations which might well be followed on the coast:

### MINNESOTA RECOMMENDATIONS

#### Objects

A. To raise the standard of plans and specifications issued by architects and engineers.

B. To educate the architects to an appreciation of fair and just charges on percentage contracts.

C. To better the working conditions with architects in the matter of form of contracts, allowing reasonable time for installing work, allowing additional compensation for overtime work, miscellaneous charges against the electrical contractor by the general contractor, etc.

#### Plans and Specifications

1. It should first be recognized that the architect is not equipped by either his training or experience to prepare plans and specifications for the electrical construction work in the more important class of buildings, but should employ the services of a competent electrical engineer for such work.

2. For small and medium size residences and other small work the committee should prepare a model specification for architects' use, accompanied by a discussion calling attention to the more important matters, giving data required for specifying high-grade work, and advice on the installation of switches, plug receptacles and special outlets.

#### Bettering Working Conditions

(See article by F. W. Lord in Electrical Merchandising, November, 1917, p. 240.)

1. Form of contract.
2. Terms of payment.
3. Miscellaneous charges by the general contractor against the electrical contractor.
4. Definition of "Cost."
5. Allowance of reasonable time for installing work.
6. Compensation for enforced overtime work.
7. Compensation for extra cost of labor when only small sections of floor slabs are made available for installing work at one time, and when work on a concrete floor cannot be made continuous from point of starting to point of completion.
8. Duty of plaster contractor in finishing at outlets.
9. Responsibility of other contractors for damage to electrical conduits and apparatus.
10. Responsibility of some definitely named person for accurate information regarding building lines and partition locations required for laying out work and compensation for changes made necessary by faulty laying out information.

### Conclusion

It appears, therefore, that a real service can be performed to the benefit of all concerned by this closer co-operation. The consumer will have his needs analyzed and cared for at a minimum expense to him; the architect will be greatly assisted in his dealings with his clients; the central station can serve its consumers to the best advantage; the manufacturer, jobber and contractor-dealer can all better serve their customers.

The next thing to consider is how best to bring this about. The success of the plumbing industry which has been referred to is due in no small measure to the campaigns of individual plumbing manufacturers, first in consumer advertising and second in specification work. The first of these is being done pretty generally now by the electrical manufacturers. The missionary work which some of them have done has met with very gratifying results. If this policy were adopted by electrical manufacturers generally the architects would soon have the same appreciation of our industry that they have of the plumbing industry.

Calling on architects promiscuously for the handling of specification work is only about 20%

VETERANS don't quit during battle

—Victory Loan

efficient. The only way in which this can be successfully done is by following definite prospects where one can work on both the owner and architect. It is absolutely essential that the one writing the specification handle the entire problem; that he gather information with regard to the service location, handle the signal system, co-operate with the telephone company with regard to the placing of their facilities, size of raceways and cabinets. In order to protect the specification which he has written it becomes necessary to undertake the inspection of the work. In this he must be prepared to maintain, provided the job is of any size, a more or less continuous supervision, which means that he must see the job when the contractor starts work, at least once during the progress of the roughing, when the roughing is completed and when the finish is in place. It is to be remembered that when one undertakes specification work the person is really acting as a consulting engineer to the owner and architect and cannot dodge any of the responsibilities. This work is, therefore, more or less costly.

One manufacturer has recently issued a very complete treatise on illumination with numerous specifications of installations already made, covering the lighting of all types of structure. Such a book is very valuable to the architect. This plan could well be followed by other manufacturers on information pertaining to their wares, and if properly presented to the architect, would be exceedingly helpful in this campaign.

For small residences standard sets of specifications should be prepared which could easily be applied by the architect. For larger residences, office-buildings, etc., a careful study should be made by a competent engineer and plans and specifications worked up by him to fit the requirements, eliminating the necessity for expensive extras or alterations after the completion of the work.

Consulting electrical engineers are sometimes called in by the architects to assist them on large installations. This practice should by all means be encouraged and where such relations exist care should be exercised by any manufacturer doing specification work that such relations are not disturbed.

This plan, if generally adopted by the manufacturers, will produce good results so far as it goes. But it should be supplemented by a well co-ordinated campaign conducted by a neutral body, representative of all the various branches of the electrical industry, such as the California Electrical Co-operative Campaign.

If the individual handling this work for the committee attempted to write specifications, with the necessary inspection involved, he would be able to cover such a limited area that it would be impracticable. Again, the co-operative man cannot write definite specifications tying up work to specific devices because he serves so many masters. The best results from a co-operative standpoint are to be secured by a practical as well as technically trained man who does not write specifications, but who will act as technical adviser to the architects. For instance, he will tell the architects about bell-ringing transformers and how they can be used, but he would not recommend or specify any particular make. He will bring to the attention of architects the line of equipment needed in various structures, tell why the equipment is needed, and where and how it should be installed. This representative must needs have a very wide practical experience in the building industry as the architect is not inclined to listen to the man who is strong on theory but weak on practice.

The point of entrance for this man should be effected by means of a circular letter campaign, which should be timed so that the subject will be fresh in the architect's mind when the missionary calls. He should frequently appear before meetings of the local architects' chapters and give the members the benefit of his specialized knowledge. New wrinkles, such as providing burglar lights on the exterior of residences, controlled by a master switch in the owner's bedroom, suggested.

The engineer should be given sufficient mandatory powers by the electrical body to whom he is responsible to enforce the compliance by the electrical contractor with the specification to the end that the contractor who attempts to "skin the job" be compelled to make an honest installation.

By such a co-operative move we can well justify the position that the exchange of our goods, our service and our ideas for profit is legitimate and ethical, provided that all parties in the exchange, and not least the consumer, are benefited thereby.

**Recommendation**

It is the recommendation of the Commercial Committee that electrical manufacturers so far as practicable, assist the architects in specification work and that the Advisory Committee of the California Electrical Co-operative Campaign be requested to work out a definite plan of co-operation with the architects on behalf of the electrical industry as a whole, submitting it for the approval of the Executive Committee of the Pacific Coast Section, N. E. L. A., the Executive Committee of the California Association of Electrical Contractors and Dealers and the California Section of the Electrical Supply Jobbers Association. It is further recommended that when the plan in its original form, or as it may be amended, has been approved by these organizations that they instruct the Advisory Committee to proceed with its execution, at the same time arranging with their individual members for sufficient increased subscriptions to the co-operative campaign fund so that the Advisory Committee will be enabled to properly finance this additional activity.

## ELECTRICITY IN BERLIN

Owing to the present coal shortage in Berlin the use of gas and electricity is permitted only between 9 A. M. and 6 P. M. and the total amount may not exceed 50 per cent of the amount used in 1916. Motion picture houses may show pictures only between 6:15 and 10:15 P. M. Living rooms and bedrooms in private dwellings may have only one lamp of fifty candle power or two of thirty-two each. Superfluous lamps must be removed from their fittings.

# Selling the Idea

BY H. L. HARPER

**(The customer doesn't buy the metal and cord, but the service which he expects the appliance to render—and it is this "result" rather than the concrete object which the electrical merchant must sell. This idea is to be carried through every type of electrical salesmanship, from the central station to the retail dealer, as is pointed out by the author who is Los Angeles manager of the Western Electric Company. The paper is part of the Commercial Section report at the coming Coronado convention.—The Editor.)**

Is it not a fact that through the rapid development of the electrical industry we have centered our thoughts more upon the engineering and the development of our products than upon successful commercial methods? If this is true, is it not natural that we have in our dealing with the public dealt more with the technicalities of our business than the service we have for their use? Have we not lead them to believe everything electrical is more or less mysterious, and that anyone in the electrical business, whether a clerk, chief engineer or general manager, is a wizard and an "Electrician"?

Mr. Electrical Man, every time you make a customer believe the electrical business is extremely technical, you encourage him to place more and more reliance in the advice of anyone in the electrical business, no matter how incompetent he may be. Your customers are liable to have as much confidence in the statement of one of your wiremen as in the advice of one of your officers, sometimes more. Your wiremen become second Thomas Edisons, and absolute authorities on all electrical questions and, of course, are usually considered friends of the people. It is only too apparent how much damage can be done to the industry by an uninformed employe.

Would it not be well for us to study our present selling methods, to determine whether or not they are conducive to the greatest results? Are we selling "The Beneficial Result" of our equipment, or are we selling the merchandise itself?

**YESTERDAY'S STYLE OF SELLING WON'T DO TODAY.**
**THE CRY IS FOR 100% METHODS.**
**CONVERSATION AND ORDER TAKING IS NOT SALESMANSHIP.**

### Selling Human Ideas

You ask what are improved commercial selling methods. They are many, but I am going to attempt to speak of but one fundamental idea, not new, but many times overlooked. "Selling The Idea," rather than the article itself.

Before the days of so-called "salesmanship" based upon the study of successful selling methods, it never occurred to the average salesman to sell anything except the merchandise itself. In other words, he spent his time selling steel, glass and the materials of which his goods were made. He was trained to know his products from the ground up, which although a necessary attribute of salesmanship, did not get him far enough.

In the meantime, merchants awakened to the fact that merchandise of quality could be purchased in many localities, from many firms, and that there were other phases to the question of buying and selling, such as advertising, trade demand, profit and turnover. Gradually, the wise salesman worked away from the prosaic, dry-as-dust arguments about the goods themselves, presenting instead the customer's viewpoint, pictured real human ideas and gave vivid descriptions of what the merchandise would do and its effect on the buyer.

For instance today, the scale salesman does not sell so many pounds of glass, gilt, springs, rods and weights. He sells the merchant "The Idea" of an accurate accounting system, "The Idea" of eliminating overweight and of losing customers through giving underweight. The banker does not buy an adding machine because it has so many red and green buttons and makes a good appearance in the bank; he buys less labor, accuracy, time and money saved and quicker and improved methods. The Kodak people do not sell a camera; they sell the Witchery of Kodakery—"The Idea" of picture making. The Phonograph people do not sell a fine cabinet, spring motor and intricate mechanism for reproducing vibration. They "Sell The Idea" of ready-made music. The real estate promoter does not sell a quantity of brick, mortar, joists and shingles, but "Sells The Idea" of a home. By "Selling The Idea" or "The Result" of electricity, the public will learn that our business is not so mysterious as they now think and when that point is reached, our field will be broadened.

### Salesmen—Not Demonstrators

Salesmen seldom have to sell a person the things they need. Anyone will come around of their own accord and buy these things because they simply have to have them. While a person's needs are few, his wants are many. The want is what lifts human beings above the plane of savagery. Primitive people want only what they need, animals are the same. Catering to the wants distinguishes civilization from savagery. Salesmanship consists of selling persons what they want and magnifying their wants in such a way that they simply cannot get along without them.

Two business men were talking about a certain salesman. One said: "He is a good man alright, but he is a demonstrator, not a salesman." I was struck with the idea and its applicability to the subject under discussion. So many so-called salesmen are merely demonstrators, all they do is to show goods. They are good demonstrators,—even passing fair dummies,—but that is all. The customer has so often to sell himself and give his money to the so-called salesman. That is not selling, it is or-

**VOTE for your self-respect**

**—Victory Loan**

der taking. You might hire boys for such jobs instead of men. Do not let your sales people become demonstrators, or, if they are already, do not expect them to sell, but secure real salesmen to get the names on the "dotted line."

### Experience with the Electric Range

At a convention of the National Electric Light Association held in Chicago when the electric range first attracted attention, the question of presenting "The Idea" instead of the product itself drew forth a great deal of comment. When the successes of the various reporting companies were analyzed, it was found those who had merely been selling electric ranges and had talked sheet iron, castings and heating elements made up in the form of electric stoves had not made much progress, whereas those who had gone out and talked "Brighter and Happier Hours in the Kitchen" and "The Idea of Electric Cooking" had reaped a harvest. The whole thing was summed up by a Manager, who said, "Gentlemen, for some years to come, electric ranges are going to be sold, not bought," and he was right. To sell ranges like many other things, enough imagination is required to look beyond the merchandise itself and so visualize what it will do for the buyer and so picture its effects that she or he will want the article.

### Using National Advertising

I would like to tell how a most enterprising electrical salesman in a middle west city makes use of national advertising by "Selling The Idea." He keeps an eye on the magazines and when he sees an advertisement of the goods handled by his company, takes a copy of the publication and calls on that portion of his prospects who are likely buyers. At the time of his visit the first question he asks is whether they have read the current issue and noticed the advertisement. He says, "I am not keen for trotting up to a prospect's house with a cleaner under my arm like a broom or brush peddler. I slip a magazine into my pocket and when I get to the door, I ask the lady of the house if she has read the publication, which almost invariably gives me a satisfactory introduction, and a foot inside the door. In other words, I first get her attention by talking about the magazine and the advertisement, after which I endeavor to intensify her interest into a desire by talking about "The Result" the device will accomplish, and what it will do for her. I keep her attention rivited on the point of making her housework more pleasant and never talk cleaners until she is ready for a demonstration. I used to try to sell cleaners by picturing my articles so glowingly that other cleaners would look cheap by comparison, the result of which was, I frequently was trapped into an argument about the different kinds of cleaners, which was sometimes fatal. To talk about the mechanical parts of a cleaner is a waste of effort. It is not the shiny nickle or the fine flexible hose, it is the fact that it will separate her from the toil and drudgery she has been experiencing in an effort to keep her home bright and cheery. That's the big "Idea," sell her on that, and she will buy any article of merit that will help her in her work.

### If Advertising Ceased

What would happen should all advertising on "Selling The Idea" of electricity cease? Is it not logical to assume that the gas engine people would take advantage of such a situation and sell their product where motors are now being used? Would not gas companies promote their product for lighting? Now, if you don't think this has some merit, take a look at the lumber industry. I was very much surprised at the contents of an article in the November 3, 1917, issue of the Saturday Evening Post, that in part stated:

> "Twenty years ago the owner of timber was regarded as a partner in an ironclad monopoly. The supply was limited and the demand rapidly increasing. As a broad proposition the timber owner had merely to wait until demand came to him and paid him his price.
>
> A late report by the United States Forest Service shows that for years substitution of other materials in the place of wood has been increasing, until it now amounts to more than five million board feet a year. Shingles have given way quite largely to composition and tile roofing; wooden sidewalks have been almost wholly replaced by cement, and so on.
>
> Disregarding temporary conditions created by war, the effect of the growing use of other materials has been to accentuate competition and decrease profits in the lumber business. Approximately seventy per cent of the lumber goes into forms of use whose demands appear to be decreasing, twenty per cent goes into strongly competitive fields. On the whole, lumber men have failed to adopt aggressive selling methods. Manufacturers of other building materials have spent large sums of money to obtain reliable information about their products and advertised extensively to make a place in the sun for themselves. Substitutes for lumber are guaranteed to meet specifications, which are easily understood by the consumer."

It is of interest to know that since this article appeared, lumber producers, especially the Southern Pine Association have advertised quite extensively the idea of using lumber.

What better evidence do we need that it is up to each and everyone of us, Central Station Operator, Contractor-Dealer, Jobber and Manufacturer to promote our business on a sound commercial basis and that it is our duty to give something to, and not altogether take from, the industry. Therefore let each of us resolve to make a study of our own commercial practices and adopt a policy of "Selling the Idea" or "The Beneficial Result" of electricity instead of so many pounds of copper, steel and brass.

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## ALL-CHINA EXHIBIT

It is stated that China's President is planning to hold an all-China exhibition at Nanking, after the constitutional strife has been settled by the peace conference now sitting at Shanghai. Telegrams will be sent to the Chinese representatives in foreign countries inviting them to have their countrymen prepare exhibits, especially of machinery, aeroplanes, submarines, and scientific equipment new to the Chinese public at home. The Chinese handicraft turned out in the republic will be a special feature of the exposition. The exhibition should interest foreign maufacturers doing business in China, as it is an unusual opportunity to see the products of this vast land of 400,000,000 people.

# Progress of Electric Cooking and Heating

BY BEN M. MADDOX

**(Electric cooking is a load which is being encouraged by western central stations. The conditions which make it a profitable addition to their business and the factors which enter into the sales problem are here discussed by the vice president of the Mt. Whitney Power & Electric Company. The paper forms part of the Commercial Section Report for the Coronado Convention of the Pacific Coast Section N. E. L. A.—The Editor.)**

Electric cooking is not a new idea, but when first presented to a prospective consumer by a salesman who knows the convenience and comfort that can be realized from the intelligent use of the latest make of electric range, it seems too good to be true. None of us can remember when the first experiments were made in electric cooking, but some of us have a lively recollection of the time when there were no cooking stoves of any sort used in the average home. It was a great step forward when the fire place, skillet and Dutch oven was replaced by a wood stove, with its kindling, wet wood and ashes. The gas burner was a decided improvement over the wood stove, and now the last word is the electric range.

### Introducing the Range

In the early days of electric cooking in California, several stations made more or less of an attempt to introduce ranges, but with rather indifferent success, due partly to the undeveloped state of the apparatus, partly to the rates and partly to the lack of knowledge and proper methods of handling the business. The Mt. Whitney Power and Electric Company of Visalia was one of the first companies in the State to make a serious effort to introduce electric cooking, water heating and house heating on a large scale. That Company in the year 1911 established a very attractive combination lighting and heating rate through one meter, which was applicable to residences installing ranges. No active campaign was started but a good steady effort was put forth to establish the business on a sound basis. The result was that though the Company served a total population of less than 35,000, within three years it had 200 installations, the majority of which were cooking, water heating and house heating. Special attention was given to keeping the devices in operative condition without cost to the consumer, though this proved to be a costly undertaking, due to the state of development of the apparatus at that time.

### Easy to Extend Use

In November, 1913, a pamphlet was published by the Company for circulation at a citrus fair in which the merits of electricity for cooking were set forth. It contained letters from 38 consumers who had been using electricity for cooking and heating, some as long as four years. All were enthusiastic in their praise of the electric kitchen. In the spring of 1914 it was decided to discontinue the sale of electric cooking outfits, and nothing further was done until the fall of 1917, when a campaign was inaugurated to increase this load. To determine how the people who signed testimonials in 1913 felt about the matter, they were interviewed again, and without exception they were still satisfied.

When solicitors began work in 1917, it was the intention to put on 1000 ranges in one year. Orders were obtained without trouble, but the cost of transformers and the necessity for re-inforcing lines, together with the difficulty of getting material on account of the war, and an unremunerative rate, necessitated a change in policy, but the campaign lasted long enough to make it certain that if the rate for this service could be adjusted and other unfavorable conditions overcome, that it would be easy to add 1000 ranges within a year.

I asked the District Agents of the Southern California Edison Company to give me their opinion about electric cooking and heating and they were unanimous in saying that it was a success and that the users were satisfied. For safety, cleanliness and thorough cooking of the food, the electric way cannot be equaled by any other form of heat. The fact that an electric kitchen can be made as attractive as any room in the house appeals to the good housekeeper.

### Interest Growing

Within the last three years a number of stations throughout the country, and especially in the West, have become interested in electric cooking. This is due to several causes, to-wit: The apparatus is being improved; the cost of other fuels has advanced; the manufacturers have made a concerted effort; and as other fields have become more and more saturated the domestic load has appeared to offer the next best opportunity for increased business. As a result attractive rates have been established and during the years 1916 and 1917 very great progress was made; but owing to war conditions 1918 was not what might be termed a satisfactory year, though in the early months a considerable amount of business was secured.

As stated above, electric cooking is now an established fact, and the station that does not encourage it actively is overlooking a very productive field. The possibilities are unlimited. In reality every residence and every hotel and restaurant accessible to the lines is a prospect and by proper encouragement can some day be made a producer of revenue from cooking and heating. It is largely a matter of rates and service. A very large proportion of the population of today realizes the superiority of electricity for cooking and heating purposes, and are only deterred from using it on account of the rather general impression that the service is expensive; but

**VANQUISHING the enemy was no joke—why hesitate at your share?**

**—Victory Loan**

where it is possible to show the electric method is not very much more costly, it is usually a simple matter to secure the business.

**The Importance of Water Heating**

A number of central stations have contented themselves with trying to install ranges only, entirely overlooking the matter of water heating, which is equally essential to the housewife and a good source of revenue to the station. In order to bring out this point more forcibly it may be stated that the consumer is generally sold on the matter of convenience and cleanliness. She is told of the great saving of labor due to the absence of fuel with its attendant dirt and danger, while every one knows that a good supply of hot water is absolutely necessary to comfort and convenience. Therefore, if the coal or wood stove is removed without provision for water heating the customer is apt to be soon dissatisfied because she has no hot water other than that which can be heated on top of the stove, which is very expensive and slow and is the cause of a great deal of dissatisfaction. If, as has been the practice of a number of stations, some other method of water heating is installed that uses fuel and the old stove is retained on account of its water coil, the consumer has still to make fires and handle fuel and she has, therefore, not accomplished what she expected and in many cases is disappointed. Now the logical method would seem to require the active encouragement of water heating and kitchen heating as well as cooking, in order that the service may be real and all that was expected. It therefore only remains for the station to establish such rates and conditions as will make the cost of this service somewhere near comparable with other fuel to open up a very large and productive source of business.

My experience and investigation leads me to believe that the 3500 or 3600 watt circulation tank heater fills 80% of the demand for water heaters today. The automatic type of water heater is used only when a continuous supply of hot water is required. The 3600 watt circulation water heater connected to 18 gallon tanks properly lagged is the most economical and most satisfactory water heater for the average bungalow, but a 30 gallon tank is found in the majority of homes, and the 3600 watt heater is used, as it gives perfect satisfaction, but is not as economical or quick as the 18 gallon tank installation.

**Improvements Needed**

It is very necessary that something should be done to improve the material and construction of ranges. Ovens rust out quite frequently and this is a constant source of annoyance to the consumer, as well as the central station. Bricks upon which the element is wound, crack and break, often. Thermometers are inaccurate. Frames of ranges are, as a rule, very light and poorly finished. Elements should be built that give the service that our consumers expect. No great number of electric ranges will ever be sold without these very necessary improvements.

The maintenance of electric ranges is a question that has received considerable discussion of late, and some are of the opinion that the central station should furnish replacements of burned-out elements at actual cost, and install same free of charge after the guarantee has expired. Many are of the opinion that the renewal of elements after guarantee has expired should be sold to the consumer at list and install same free of charge. Others believe that the manufacturers should extend the guarantee on elements as long as the central station must stand the brunt of the up-keep and repair of ranges. This is a question that must be reckoned with in the very near future, because, as the time goes by, the trouble multiplies.

**Questions to be Settled**

It is the consensus of opinion that there are entirely too many types or styles of ranges handled by the central station. In the first place, it necessitates the investment of a very large sum of money and, naturally the depreciation of shop-worn ranges, and the expense of handling so many styles, amount to quite a large sum of money each year, and the fact that it takes twice or three times as long to sell a range where there are so many to select from. It does away with so many different opinions among housewives as to which style or type of range is the most suitable. It will save one-half the salesman's time, and cut the cost to the central station of handling this business, at least 20%.

From the Central Station standpoint the rate is of first importance. It must be high enough so that those who use electricity for cooking will pay their just proportion of the fixed charges and operating expenses. In making rates, the Commercial Department may have had too much to say in the past, but in this day of scientific rate fixing, the engineer must be consulted. It is not possible to take on much of this business without the expenditure of a large sum of money in reconstructing lines that were not intended for this service when originally built. Close regulation is necessary, for the lack of a few volts may make all the difference between a satisfied or a disgruntled consumer.

Another question that will cause some thought is whether the Central Station or the Contractor-Dealers shall sell the range and waterheater. If the Central Stations give up the business, then there must be the closest co-operation between the local dealer and the power company, and it is very doubtful if this can be brought about. There will be on every system localities where such additional load can be taken on without much expense, while in others the cost will be prohibitive. The man that makes the sale must know about this before he makes a proposition to place a range. On the other hand, it requires a large amount of money to buy stock in such quantities that the greatest discount can be secured. The cooking and heating load has been obtained so far only by the Central Stations financing the campaign and using its own men to solicit the business.

**If the Man Kept House**

The Central Stations have a monopoly in most of the uses to which power may be applied. For

the man, no argument is required to convince him that his interests require electricity in the factory or on the ranch. Whenever the so-called Lord of Creation finds the need of energy to operate any machinery he is called upon to keep in motion, he specifies electricity. It is the twentieth century way of doing things and that is the end of it. It has been somewhat of a struggle to convince the average man, however, that the home should receive the same consideration that is given a rock quarry, planing mill, packing house or pumping plant. It is thoughtlessness, or selfishness in many instances on the part of the man, and I have often wondered how long it would be until electric ranges were installed in every home that is adjacent to an electric line, if the man had to do the housework.

# The Contractor-Dealer of Tomorrow

BY JOHN C. RENDLER

**(The possibilities within the grasp of the contractor-dealer are unlimited. Suggestions as to the immediate fields which may be conquered by both the contractor and the retail merchant are offered for practical consideration by the president of the Southern California Electric Company as part of the Commercial Section Report of the Pacific Coast Section N. E. L. A.—The Editor.)**

"There is a tide in the affairs of men, which taken at the flood, leads on to fortune;
Omitted, all the voyage of their life is bound in shallows and in miseries."

On such a full sea are we now afloat, and we must take the current when it serves, or lose our ventures.

How well the words of Shakespeare will apply to the Electrical Contractor-Dealer of Tomorrow, time alone can tell. Are we ready to take the current when it serves? I say we are. In order to more clearly define the scope of the "contractor" from that of the "dealer" and because there is a distinction between the two, I am going to deal with them separately.

### The Future Contractor

The Contractor of Tomorrow is a man neat and clean in his personal appearance, his associates are architects, building contractors, and proprietors of commercial and industrial businesses. He will have a thorough knowledge of his business, its possibilities for development, expansion and opportunities. He will use only highgrade materials and employ good machines, because no business can progress on any other principle.

The contractor will consider his vocation worthy and as affording him an opportunity to serve society. Society demands honorable business methods and unless a business is constructed on such a foundation, all of our ventures will be lost. We will associate with men who compose the other branches of the industry, make our dealings with them, as also our competitors, on an ethical basis, thereby retaining their friendship, have access to their council and advice, keep abreast with the times, particularly in our own industry, then, and not until then, take the current when it serves.

**Residential Work —**

In residences and apartment houses, too little attention has been paid to correct illumination, wiring for lamp socket and heavy wattage appliances. We so often find a residence in which the wiring has been poorly laid out. The general illumination is not sufficient for the room, the color of the walls and ceiling have received no consideration, the fixtures are selected from the standpoint of beauty and price rather than efficiency, and a harmonizing effect. The switch locations are placed at the most convenient place for the contractor, rather, than for the consumer. I have seen some very fine residences and apartments, recently constructed, with no provision for the many labor-saving, lamp socket devices. Here the Contractor of Tomorrow will demonstrate his knowledge. No residence or apartment house will be wired by him, or under his supervision, that does not have provision in every room for a plug, of sufficient capacity for 660 watts. In addition to these, provision will be made for the special plugs to care for the washer, cleaner, iron, toaster, percolator, and the curling iron in Madame's boudoir. A few other important provisions should be made. No modern residence or apartment owner, will be permitted to overlook the necessity of providing for the electric range, water heater, or large air heater. While these electric devices are prohibitive in some localities at the present time, there is no doubt in my mind but that they will be as universally used as the electric iron, and in a very short time. Special care will be given to the wiring of all lamp sockets and heavy wattage appliances, to see that the circuits are wired heavy enough to carry the full load, proper fusing facilities, and entirely separate from lighting system. The time to have these provisions made in the wiring is, before the plans leave the architect's office, therefore the contractor will lend every effort, to see that the architect is fully conversant with the advisability, and necessity, of providing base plugs and special outlets. While I have used the residence and apartment house in my discussion, the same condition holds true to quite an extent in office buildings and to an even greater extent in some.

**The Industrial Field —**

Here the contractor will grasp the opportunity, which for numerous reasons in the past, he neglected to take. By hard and consistent effort, both as to salesmanship and, a better understanding of their requirements, he will win back the thousands

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**ERBAL patriots can now prove themselves**

**—Victory Loan**

of dollars in business that he has lost, on account of the industrials doing their own work.

Make a study of power and the relative values of it, so you can show the economy of individual drive on machinery over the long line shaft and belts that are largely in use today. Show the many advantages of electric drive over gasoline, or steam, to those who are still inclined to believe they have the best system of power. Show the manufacturer how he can increase his production, by better lighting in the factory general, and by properly lighting the individual machine. The safety of employees in the factory is very essential, therefore recommend and use necessary safety devices that will add to the protection of life and property. All motor maintenance will be done by the contractor, when he puts himself in a position to render service. A motor stopped in a manufacturing plant means the loss of time of one or more men, but this is small compared to loss entailed by the cutting off of the output of that machine. We must be ready to give instant service, make the repairs as quickly as possible, commensurate with good workmanship, charge a fair price for the labor performed and the material furnished, thus giving such efficient service that the ordinary industrial plant cannot afford to maintain its own electrical department.

Again, we have an opportunity to demonstrate the many advantages of heavy wattage appliances, this time in the factory. Electric furnaces, ovens, spot welders, glue pots and hot plates are all tried and proven devices, and an opportunity should never be overlooked to recommend their use.

There are one or two obstacles which stand between the contractor and the industrial business, which I firmly believe when the contractor shows he is making every effort to secure this business, that he is deserving of it, that the jobber will see the fallacy of recognizing every industrial as a trade buyer. The manufacturer of motors will discontinue selling their product direct to the consumer, and will revise their policy, allowing the contractor a sufficient margin of profit to warrant his doing the sales and engineering work. The contractor, who is not an electrical engineer may not be aware of the fact, that most power companies maintain a corps of engineers who will lend him, without charge, any assistance desired, in laying out new plants or remodeling old ones. The offer of this service should be appreciated and used advisedly.

**Electricity on the Farm —**

A large, new and undeveloped field is open to the electrical contractor in the use of electricity on the farm. I have a vision of driving out the country boulevard and stopping at the modern farm. The first thing we notice is the light at the entrance gate; as we drive in we find the yard and all the buildings are lighted on the outside. On entering the milking room we find that electric milkers are used exclusively, the building is well lighted, and motor driven conveyors are used for handling the milk and feed. In another small building we find the food chopper electrically driven. The separator, the churn and ice-cream freezer are driven by motor, and in the laundry the washing machine and iron hold forth ready to perform their service at the touch of the button. In the barn, we find a motor connected to a hoist, for the purpose of raising the feed to the loft, or loading the wagon. All the wood is sawed by an electrically driven saw. The water the farmer drinks and that with which he irrigates his land, are pumped by an electrically driven motor. In fact, I believe the modern farmer has become so energized with the electrical idea that he is largely propelled by the thought of it.

What has been said about wiring, switches, base plugs and heavy wattage appliances for the residence and apartment house, apply equally as well in the modern farm house. In fact, the heavy wattage appliances are more essential on the farm, because in most cases gas is not available for heat or cooking.

In localities where there is no power available, another field opens to the contractor—that of furnishing farm lighting plants complete. I would not recommend one in a place where a Public Service Corporation could serve, because the private plant is limited in its capacity, requires more care, and the first cost is quite a factor. Also, the private plant cannot be operated as economically as the power company's service can be purchased. The possibilities, however, for wiring and motors in the private plant are similar, with the exception of their limited capacity. With the modern farm, having from one to ten motors, a good business in maintenance may be worked up by the contractor, and what has already been said about service, in industrials, applies equally well here. By all means make the farm wiring and installation comply with all state safety rules, even though it may not be inspected. With this tremendous field open to the contractor now, almost at its birth, he will do well to fit himself for immediate action, grasp this opportunity, for some one surely will, and let it not be a plumber or a blacksmith.

I have endeavored to cover some of the problems of the Electrical Contractor of Tomorrow, and to suggest solutions of these poblems; it is now my purpose to enumerate some of the opportunities of which the Electrical Dealer of Tomorrow will take advantage.

**The Dealer —**

Considerable has been said about the electrical dealer as a merchant, all of which has been very instructive to him. I believe, however, that as he is young in a business way, he must, as a child, learn to crawl before he can walk. In establishing a location, two things must be borne in mind: First, the traffic or shopping procession; Second, the possibilities of the city's future development. These two things for permanency, as establishment in a particular location is a valuable asset to a merchant. A move is very expensive. The selection of a store, whether it be on a corner, or in the middle of the block, depends upon the rent, and more particularly upon the gross profit upon which you work in the

sale of your merchandise. The gross profit allowed the electrical merchant today does not permit of him opening a store in the heart of the shopping district.

A location being selected, "regardless of the district," too much consideration cannot be given to the furnishings. A carpeted floor, if possible, enclosed glass wall cases and show cases, to properly display merchandise and to keep it clean. The shelves where the small devices are kept, should receive especial attention, for there are a number of stores whose general good furnishings are marred by the appearance of their shelves. The store, wall and show cases should be well lighted, thereby offering the suggestion to your customers of better light. If the store arrangement will permit of it, I would have two windows, so that one would always be on display, while the other was being trimmed. To obtain the best results, a window should be trimmed once every week, concentrating in your display on one thing, rather than trying to show everything you have in your establishment. A valuable lesson has been taught to the dealer, which the Dealer of Tomorrow will take advantage of—that of stocking inferior merchandise and appliances. No appliance, device or merchandise, will be put on the shelves for sale, that does not carry the personal guarantee of the dealer. The time has passed when a customer, bringing in a defective article, will be told that it will have to be sent to the manufacturer for replacement. I firmly believe that had this policy been in effect for the past five years, the electrical dealer would today be doing 50% more business. The consumers finding that the electrical merchant's wares were no better, and his service poorer, they made their purchases at the hardware, department, and grocery stores on account of their convenience.

Next to highclass merchandise for sale, comes the necessity of highclass salesmen to sell it. A salesman will either bring repeat customers or drive them away. See that your salesmen are possessed of good personality, understand your merchandise thoroughly, are well dressed and neat in appearance, though not expensively; are kind and courteous, and your business will grow by leaps and bounds. Install a good delivery and repair service; it is necessary, as the customer has been educated to expect and demand these things. Join your Association, your Chamber of Commerce, your Rotary Club, or any other business organization that is interested in building up your city, and thereby take your place in the front ranks of your city's business activities.

**Business Building —**

A short time ago this part of the dealer's business was a puzzle of considerable moment to him. At each thought of some plan to build new business, he was confronted with the plan then in effect by the power company. He could not sell at their prices, meet term payment plans, or make repairs free of charge. Happily, this is a thing of the past, and the change is due to the efficient work of the Advisory Committee of the California Electrical Co-operative Campaign. The committee's work has been and is now along progressive lines, lending every opportunity to the dealer to take over that part of his business which has been such a puzzle to him. Again I ask, "Will the Electrical Dealer take the current when it serves?" I answer, "He will." How is he to go about it?

He will advertise to the limit of his financial possibility, his name, his business and his location. Let me say here, that I do not believe it would be amiss if the manufacturer apportioned some of his National advertising fund for use in fertile local fields. Since practically all agencies for specialties and appliances are exclusive, and are distributed through an electrical jobber, he also should do local advertising in some form, either through the newspapers or by campaign, always referring to the dealers as his sales agents. The dealer will do seasonable campaigning, employing highclass salesmen to canvass the city, in the same manner as formerly employed by the power companies. The adoption of the term payment plan on the larger devices, is absolutely necessary, and properly handled will be the best business builder the dealer has. Advertise this feature of your business at all times. Select a good standard line that is well advertised nationally, and then show in your advertising why this commodity should be purchased from you, rather than elsewhere. Tell the public about your service department, your personal guarantee, your knowledge of things electrical, all of which will enable you to serve them better. Your window is your best salesman. Make use of it. Tell your story to the passer-by so that he gets it at a glance, and once you get him in your store, good salesmanship will do the rest. We must get our name and business before the public, and in much larger type than we have been able to do in the past. The down-to-the-minute dealer is soliciting consumer lamp contracts. The lamp business is not only profitable in itself, but serves as bringing additional business from the consumer. The dealer's progressiveness will lead him into many fields in which the harvest is very poor now, among them the office building and some industrials. By his consistent effort and progression, the jobbers and manufacturers who are now serving this class of trade, will see the advisability of discontinuing their efforts, and leave the work and the business to the dealer. No jobber or manufacturer should solicit or accept a consumer lamp contract, when there are progressive dealers in the vicinity.

A manufacturer should not sell motors direct to the consumer, when he finds the dealer ready to perform the service that is necessary. In other words, when the dealer perfects his selling force to its highest efficiency, his only competition will be from his competitor dealer, and then on an ethical basis.

**Accounting and Collections —**

As we develop our business, its growth demands of us a better accounting and collection system. Adopting the term payment plan for selling

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**VALOR to the end from the boys — merely money from you**

—Victory Loan

merchandise, without developing an accounting and collection system to handle it, would mean absolute ruin to the dealer. I would recommend a separate ledger for all term accounts, using a card follow-up system. Adopt a policy at once, allowing not more than two payments to lapse without taking back the merchandise. Notify your customer about five days in advance of date payment will be due. Try to get them to come to your store to make their payments —it means additional business to you. Use good judgment when sickness or accident prevent a customer from paying, but accept no fake story. If you have sold good merchandise at an honest price, you are entitled to be paid for it. Numerous failures are recorded on account of poor collecting methods, and the fear of hurting your customers' feelings, by asking them for what is justly due you. The accounting department should be kept so that you can get complete information regarding any part of your business. Your monthly report should be as complete as your annual report, with the exception of a physical inventory. The merchandise account should show you the number of times per year you turn your stock. Your sales account is your stimulator, and you are the stimulator for your organization. It also gives you the figure from which to make your advertising appropriations. It shows you the advantage of discounting your bills. You get a monthly comparison of one month with the next. Also, comparing a month with same month of the year past, you can ascertain if you are maintaining a steady growth. Each department should be kept separately, and bear its ratio of the general expense; in this way you know from where your profits are derived, as well as the source of losses. I know of a case where a department had been losing approximately $350.00 per month for 2 years, and it was never found out until a good accounting system had been put in. I believe it is the best money a dealer can spend. Thousands of dollars are being stolen annually from dealers in this state, by sharp bookkeeping practices and other schemes, nearly all of which could be eliminated by proper accounting systems. Have your books audited by an expert accountant at least once a year, and twice if you can afford it.

Another vital point of your business that is brought to your attention by a good accounting system, is your cost of doing business. You must constantly watch this important item, or your expense will grow without your noticing it. A good form for this is to have your bookkeeper list your overhead on a separate sheet in monthly order, so that at a glance you can see the comparisons.

**The Consumer —**

There is nothing so essential to the success of our business as the good will of the consumer. It is easy to discuss the progress of the contractor-dealer, the many new fields in which he has to work, and the planning of this work, but the success of it all is held in the hands of the consumer. We can obtain this good will only, by preparing ourselves to be generous in the extension of good will to others. Make as the main policy of our business, Honesty and Fair Dealing, inculcate this idea in the minds of our organization, advertise it, then by all means, PRACTICE it, and we will be doing justice to the consumer, to ourselves, and to our profession.

In summing up the possibilities of the Contractor-Dealer of Tomorrow, it seems to me, there never was a time in the history of the electrical business when opportunities such as we now enjoy were within our grasp. I should say it is now up to us to show that we are capable of handling the situation, of putting forth renewed effort, or re-energizing our selling forces, of establishing new forces to care for new fields, of living up to the claims we have made in our own behalf, and show in the words of Shakespeare, that, "On such a full sea are we now afloat" we will "Take the current when it serves" and so "Lead on to fortune."

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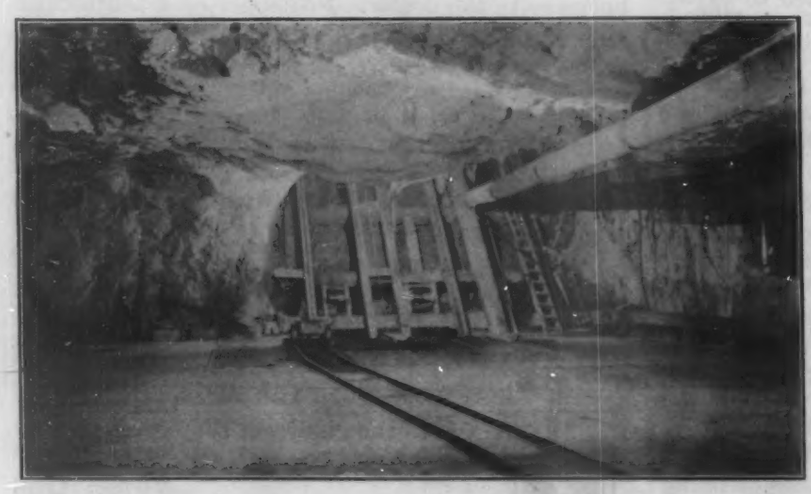

**A lighting installation 1800 ft. underground. This is the 1800 ft. shaft station in the Keystone Mine at Amador City, Cal., one of the oldest and best known gold mines in the state. This is a far cry from the candle-in-the-hat illumination and indicates how electricity is being utilized in our mines. There are 4–100 watt lamps in the reflector. The photograph, which was taken by E. R. Higgins, up to recently efficiency engineer with the California Metal Producers' Association, represents the effect of a 10 minute exposure.**

# Appliance Sales Policies

BY T. W. SIMPSON

**"Shall the Central Station remain in the business of selling electric appliances, or shall it drop this business and leave it to the dealers? The author, who is western district sales manager of the Federal Sign System (Electric), presents a strong argument to prove that it is better for the prosperity of the dealers to have the Central Station remain in the business of selling electrical merchandise. The paper forms part of the Pacific Coast Section N. E. L. A. Commercial Section Report.—The Editor.)**

Developing the load of the small consumer does not possess the glamor nor does it appeal to the imagination as does creating huge power and industrial loads, but it is equally important. A slight increase in the consumption of many thousands of residences and stores means a vast total of electrical load considered in the aggregate. As the development of this load is inseparably connected with the sale of current-consuming devices, it becomes the duty of all branches of the industry to study most carefully the best manner of interesting the consumer in the utility of these articles. No permanent interest will be aroused unless the fundamental policies are correct and therefore the first consideration of this paper is to analyze basic sales policies, after which follow suggestions as to application.

**The Nature of the Merchandise.**

A skilled merchandise manager of the type developed by modern department stores, if unfamiliar with electrical apparatus, would ask many pointed questions concerning electrical devices which probably have not been considered by many of us who live so close to the electrical business that we lack perspective. Such an investigator would quickly determine the following characteristics of electrical appliances which are listed herewith without argument as to their being good or bad, but because they have a bearing upon the determination of proper sales policies.

**(1) Relatively High First Cost —**

One cannot deny that a ten-dollar electric heater looks small compared with a kerosene or gas stove of the same price, and so on through the list. The electric article is usually high compared with its competitor.

**(2) Considerable After-Service Necessary —**

Those of us who have had thrust upon us the duty of "fixer-in-ordinary" of all the electrical devices in our neighborhood just because we are in the electrical business appreciate the important bearing that service has in keeping appliances in continual use. No permanently successful policy can afford to neglect this important feature.

**(3) Few Staples—Many Specialties —**

The merchandise expert regards a staple as something that partakes of a repeat demand and that is purchased solely for its utility. The only pure staples of the industry are the lamp and the fuse. Semi-staples are the iron and the fan, and owing to recent abnormal conditions, the washing machine. A fair percentage of the business in semi-staples comes from people asking for them. All of the other articles are specialties for which there is very little "call" unless it is for gift purposes. These goods require forced methods of salesmanship, commonly called specialty salesmanship. To a degree the semi-staples also require this plan of selling.

For instance, a large drug company endeavored to sell electrical appliances of well-known makes by the usual methods that would move celluloid hair-brushes, by window and counter display and the results were very unsatisfactory. A large tea company endeavored to use a well-known line of appliances as a premium but found their wagon drivers received few requests, the women preferring sets of china dishes and the usual run of premiums.

**(4) Published List Prices and Fixed Discounts —**

The merchandise expert, knowing the nature of the goods as above suggested can easily devise means of selling which will move large quantities of them, just as he can move sewing machines or phonographs, but when he applies the "mark-ups" that his experience shows will cover the cost of selling, he finds a conflict with established list prices which to him do not provide a margin to make profitable a strong selling campaign.

For instance, the largest furniture store in a large California city reported that they handled vacuum cleaners purely as a convenience and because they desired to be able to supply all the casual demands of their customers. They refuse to campaign such a device because any such selling effort expended by them would have to go on lines carrying a profit margin able to pay the expense of such a campaign. Their phonograph department can afford specialty salesmanship methods because their cost of goods was from 40% to 50% of term payment selling price. Their rugs carried about the same margin, and in neither instance was there the element of "after-service."

**(5) Patent Control —**

On the lamp, heating devices and vacuum cleaner, our merchandise expert would discover patent control tending to high prices and elimination of competitive buying.

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From these viewpoints he would conclude that conditions were not very favorable for profitably marketing large quantities of appliances. His conclusion would be to arrange to care only for the casual demand by counter display, but as the rental

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VARNISHING patriotism with words wins no war

—Victory Loan

value of such display is very great in high-class establishments he probably would place it in an out of the way corner.

The conclusions reached by our merchandise expert would be correct except for the existence of a very important factor, which is an active force in many localities, passive in others, but always potentially strong. For want of a better name this factor may be called:

**The Weight of Authority of the Central Station**

Present discounts and profit margins on appliances are based on the cost of doing business of the central station sales department, and not upon the cost of doing business of an isolated retailer except for the simplest sort of service, such as wrapping, delivering, collecting and now and then a minor accommodation repair. A central station can buy at dealer's discounts and conduct a sales campaign with demonstrators and door to door men and show a fair profit, but a dealer cannot do so unless, and here is the whole point of the argument,—unless the central station in the town is also doing so.

This important principle will be explained and amplified by studying three hypothetical cases below:

**(a) Case of Central Station Conducting a Retail Sales Department**

There is ample evidence that the central station can conduct a retail sales department and sell a large volume of goods at an actual merchandising profit without the necessity of cutting prices or conducting unethical practices reacting against the dealers. The actual results of such a condition in a certain Western city covering the sales results of ten months ending December 31, 1918, and involving the sale of about $425,000 worth of merchandise figures as follows:

| | |
|---|---|
| Selling Price | 100% |
| Cost of Goods | 71.14% |
| Cost of Installations | 3.49% |
| Total Sales Expense | 5.61% |
| General Expense | 7.85% |
| Fixed Charges | 3.75% |
| Net Profit | 8.16% |
| | 100% |

This central station figures on an average of slightly more than two turnovers of invested capital yearly in the sales department, so the net profit figures not far from 19% on the investment. The table covers all rent, advertising, collection expense, discounts, apportionment of depreciation, executive salaries, etc., and is the result of very careful accounting practice by one of the largest corporations in the country.

Inspection of this table will show that the cost of goods is about the same per cent of selling price as is paid by the dealers. The selling expense is exceptionally low on account of the weight of authority of the central station. People regard their power company as an oracle on electrical matters and feel that they will be well cared for in their dealings. Everyone paying a bill, filing a complaint, or ordering a service must pass through the display-room, thus creating at no cost a select clientele which can be reinforced by specialty sales methods of various sorts. The collection expense is very low because the machinery for collections already exists and the extra cost of collecting appliance installments is almost nil. Most important of all, the central station is bound to make a success of appliance selling because the utilization of the devices is wrapped up with its general electricity supply business. The central station has something else at stake besides merchandising profit.

**(b) Case of Retail Contractor Dealer in City Where Central Station Does Not Conduct a Retail Sales Department**

Mr. Dealer operates in a city where the central station is "out of it," possibly by his own activity, he feeling that the central station should not compete with him. First comes the belief that the power company business thus stopped should come to him. But it does not do so. His store sales are little if any heavier than before. His competitors have not done any better than he. The power company sales seem to have vanished in mid-air. He will then try door-to-door men, often the very same men dropped by the central station, and he finds they sell about half as much for him as they did when working in the name of the central station. This makes the direct selling cost double that of the central station. Newspaper ads are tried. Floor demonstrators are tried. Results are far from what was expected. The central station is appealed to and it donates its newspaper space, but on account of the general nature of the advertisements they cannot excite much direct action to buy, as they dare not specify one make of article or one definite place to purchase it, or give definite reasons for buying now instead of later.

In cases of all except the few that prove the rule, the year ends with disappointments and a dawning conclusion that high pressure selling plans are not for him,— that the only real money is to be made in the contracting end,—that appliances may help out a little on the rent but that is all. He concludes to place no selling effort on appliances other than attractive show windows, clean counters and well-kept stock. There is no driving impulse compelling him to push the appliance busines because he can always fall back on the contracting end. The weight of authority of the central station is not utilized in any direct positive way. The appliance business becomes passive.

During the past year, due to shortage of help, there has been an abnormal demand for labor-saving devices, notably the washing machine, and this has stimulated dealers' sales to a degree. However, indications are plain that sales are overwhelmingly greater on these devices in territories where the central station is actively in the field than in localities where it is not. Information gathered in one of the largest cities of California developed the fact that there was not a single door-to-door salesman at work on electrical appliances, except such cursory calls as the proprietor himself would make in the attempt to sell a few washers, etc.

The conditions described in this section refer to those of the bona fide contractor dealer, and not to those dealers possessing a sub-rosa connection with a central station, jobber, or manufacturer, thereby not being subject to the same forces of necessity.

**(c) Case of Contractor-Dealer Operating in Towns Where Central Stations Conduct Active Merchandise Selling.**

It cannot be denied that deplorable conditions have existed in the past in such towns, and the conditions still exist in many of them, but fortunately these conditions have been corrected in California, at least, due to the effective work of the California Cooperative Campaign. When the central stations gave free lamp renewals, sold appliances at cost, spread the payments over long terms without adding interest, gave away new electric irons for "any old iron and 98 cents," etc., it was no wonder that the dealers rebelled and they cannot be blamed for scotching out the life of such a pernicious system with every means in their power. Assume though, a condition where the live-and-let-live philosophy of the Goodwin Plan is the rule, where the central station sells at full price with a little better for terms, where it concentrates on a few makes of articles instead of trying to monopolize every line in the market, where its sales department is not overzealous and is guided by the ideal of total volume for all branches of the industry rather than for high totals of its own making. Such altruistic policies do exist, and the lot of the contractor-dealer in such a city is a most happy one.

By a surprisingly small amount of effort Mr. Dealer can do a big appliance business. Mrs. Brown is sold the idea of owning a washing machine by the careful sales-work of the power company solicitor. Woman-like she decides to look around a little bit. At her neighborhood dealers she sees a washer in the window of a different make and stops to inquire as to its merit. Mr. Dealer can match the power company price and proposition. He can make her believe his machine is as good or better. He dwells upon the advantages of buying through him,—closeness for service, etc. Mrs. Brown stands a very good chance of being sold on the spot.

Mr. Smith, storekeeper, is approached by the power company solicitor to put in modern window lighting. The fact is developed that the contractor has the same proposition, with what to him is a superior reflector. Mr. Smith can see that it is just as good. Mr. Dealer says, "Buy of me, I and my friends buy of you, etc." The sale is made.

Even door-to-door men now pay the dealer because the weight of authority of the central station has impressed the consumer with the necessity of the device, and the dealer's salesmen grab their share of the business. The dealers lose many sales to the power company and vice versa. The total volume of sales is very large. The dealers' share is big. The crumbs from the power company's table develop more business for the dealer than he can hope to develop by going it alone.

That this is no Utopian dream is proved by the facts obtained concerning conditions applying where the power companies have long adhered to the policies above described. Some dealers can be found in these cities who complain and think the power company is taking bread from their children's mouths, but such complaints come only from those few who lack business sagacity or who lack the imagination to correctly forecast the conditions that would exist if they had their own way and could put the central stations out of the business. Most dealers and all jobbers are very friendly with the central station. Describing the conditions existing in one of the cities of this classification Mr. J. F. Derge, Superintendent of Sales of the Utah Power & Light Company, Salt Lake City, reports on this phase of the matter, in part, as follows:

"Our policy, as evolved during six years' development, is practically that of the Goodwin plan as applied in the East. We have established our merchandising along certain definite lines consistent with good business policy. We sell strictly at retail. However, we reserve the right to put on an occasional feature sale whereby we make some concession which might prove attractive to the buying public. This need not necessarily be a cut in price except on articles that have been slow moving or are obsolete so far as up-to-date devices are concerned, but good for whatever purpose the customer may wish to use them for. Particular attention is being paid not to encroach on the other fellow's field. Any business of a jobbing nature is always referred to the local jobbers. Our retail sales, for the most part, are at manufacturers' lists and we adhere strictly to them.

"So far as we know the sentiment of the dealers throughout our territory is good. In fact, Mr. Alexander, formerly with the Society for Electrical Development informed me that he knew of no section in the country where the relations between the dealers, central stations and jobbers was any better than here. . . .

"It may interest you to know that our activities along these lines have meant increased sales for all the dealers. We know this to be a fact by admissions made to us by them. Practically all the jobbers are willing to line up with us for some leader or other which they might handle for the reason that they are assured an increased volume in sales because of our activity in these lines, not because of our own sales, but because of the interest that is created amongst their customers. The fact that the power company accepts an appliance as a selling proposition encourages other dealers to do the same.

"In connection with the regular line of merchandising, it may be well to mention our appliance repair policy which was instituted a few years ago. This has been carried out principally in Salt Lake City and Ogden. We find that we are actually repairing more appliances through our Fix-it Department than the number of new appliances sold throughout the year. This is indeed an important item from the current selling point of view when you consider that the merchandising was primarily entered into for that purpose. In Salt Lake City division alone the number of repairs made through our Fix-it Department amounted to 10,879 during 1918. A sufficient amount is charged to provide for all overhead. The psychological time for the customer to want his appliance repaired is when he comes to our store to pay his electric bill. It is at that time he thinks of the defective appliance and naturally brings the appliance along with him. This follows the line of least resistance. If it were necessary for him to go out of his way to have the appliance repaired, the chances are that the appliance would not even be thought of and left lying on the shelf."

"Since writing you we have had further occasion to realize that our policies are right. A Washer Campaign was instituted the first of March and during the first two weeks of the campaign, we sold 366 machines. With a casual meet-

VOUCH for your patriotism

—Victory Loan

ing with contractor-dealers and jobbers we always take occasion to make inquiry as to their sales on this item. In every instance we have verified to us that their business has been stimulated to a very marked degree because of our campaign methods. Some of these dealers have offered the information voluntarily. This stimulation is also indicated by the large number of inquiries coming from points outside of our territory. Nor is this confined to ourselves. We learn that practically all dealers are receiving these inquiries as well as we."

Through the courtesy of Mr. W. R. Putman, Manager of the Commercial Department of the Utah Power & Light Co., we are permitted to present the following table, which is of interest from many standpoints. It portrays the very large use of electrical appliances in the territory, which figures are surprising when one considers the territory covers only 50,888 residence consumers. It shows the totals for the calendar year of 1918 as to number of articles sold by the power company, and a close estimate of dealers' sales during the same period. This sales report should give all parties food for considerable thought:

TABLE SHOWING SALES IN TERRITORY OF UTAH POWER & LIGHT CO—CALENDAR YEAR 1918—50888 RESIDENCE CONNECTIONS

Number of Articles

| | Sold by Central Station. | Sold by Dealers.—Estimated. | Sold by both Dealers and Central Station. | Number of articles in use on Lines. Total. |
|---|---|---|---|---|
| Lamps | 156,000 | 226,000 | 382,000 | |
| Ranges | 679 | few | 679 | 2,376 |
| Grills and Discs | 1,462 | 950 | 2,412 | 11,536 |
| Water Heaters | 224 | few | 224 | 750 |
| Percolators | 405 | 300 | 705 | 1,560 |
| Fans | 309 | 900 | 1,209 | 3,500 |
| Irons | 3,741 | 2,500 | 6,241 | 56,934 |
| Washing Machines | 1,708 | 1,700 | 3,408 | 11,285 |
| Cleaners | 956 | 1,000 | 1,956 | 4,469 |
| Other Appliances | 2,497 | 2,000 | 4,497 | 8,500 |
| [1] Signs | 31 | 10 | 41 | 1,122 |

There are many other evidences of the importance of the central station engaging actively in merchandising in order to insure the prosperity of the dealer. The writer's business relates largely to the electric sign field which articles require specialty salesmanship. A few years ago in Oakland we operated an electric sign campaign with the direct cooperation of the central station. Our competitor in the city thought ruin was staring him in the face. Instead of that he became so busy that his factory had to expand into the adjacent lot, so great was the amount of business developed by the central station that he was successful in obtaining. Since the time of that campaign the Oakland electric sign business has languished for us and for our competitors as well in spite of unprecedented prosperity of the city.

To apply the shoe to the other foot, at Stockton the central station operated a sign campaign recently, buying signs from our competitor. Yet we were able to place more dollars worth of signs in Stockton than in an adjacent city during the year in question, even though we maintained a man at the nearby city more or less permanently, and only visited Stockton occasionally. We would prefer to have the central station actively campaign another make of electric sign and seemingly work against us than to remain passive and do nothing.

The Goodwin plan, in which we are all believers, states in Plank 7 to the effect that central stations shall maintain retail sales departments in order to provide additional points of contact between the consumer and the electrical industry. This is a different idea than many of us have had as to the Goodwin plan, but the desirability for the incorporation of that plank must have been due to the overwhelming mass of evidence of the nature described herein.

The platform of the California Co-operative Campaign embodies the principle that central stations shall not be asked to discontinue the sale of appliances. However, there is a tendency to make such requests by implication, if not directly. Instead of there being any such feeling as this, it is believed by many that there should be a definite movement in the opposite direction so that the central stations will remain in the field very actively. The supervisorial powers of the California Co-operative Campaign should then be directed, in addition to its present objects, to the task of keeping sales practices of the central stations in proper ethical channels. Only in this way can the industry receive the benefit of that powerful influence—the weight of authority of the central station.

The activities of the California Co-operative Campaign have been remarkably conducive to the welfare of the industry. Let the good work continue. Let it add to its functions the duty of controlling in an advisory capacity the sales policies of the central stations as well as the dealers. The powerful influence of the campaign leaders should be brought to the support of a policy that will prevent central stations from cutting prices, giving free lamp renewals, selling on term payments without interest, installing articles (such as ranges or signs) at nominal expense without offering the same privilege to goods of the same nature sold by dealers, and last but not least, acting to limit the manufactured lines that a central station can sell in order that the dealers may have their own exclusive lines and talking points.

[1] Lightless nights and steel restrictions in 1918 affected this item adversely.

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## CORRESPONDENCE COURSE FOR ELECTRICAL WORKERS

The following announcement, of interest to Journal of Electricity readers, was made in a recent bulletin published by the University of California:

**Subject: Correspondence Course for Electrical Workers**

To meet the needs of electrical men throughout the state, a correspondence course taking up the various phases of electrical study has been prepared by the State University Extension Division, with the endorsement of the California Cooperative Electrical Campaign, a state-wide organization made up of electrical dealers, manufacturers and of those concerned with central power stations.

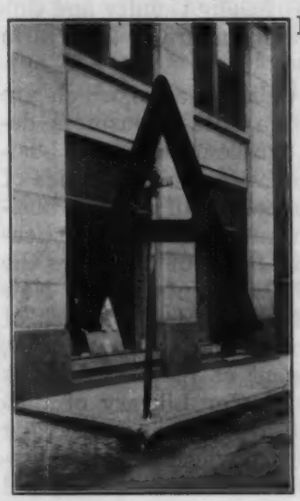
The course aims at giving fundamental instruction in electricity to stations operators, office employes, salesmen, contractors, dealers, jobbers, telephone and telegraph men, manufacturers' employes, repairmen—in fact to everyone connected with the electrical industry. A series of 15 articles, constituting the text book for the course, is to be published, beginning at once in successive numbers of the Journal of Electricity. Several pages of mimeographed instruction material sent out by the Extension Division to those enrolled in the course will supplement the articles. Enrollments are being received at the University Extension office, California Hall, Berkeley.

# The Business Library

BY LOUISE B. KRAUSE

**(When you need information, where do you turn? Do you call upon acquaintances on a chance—or do you make use of the resources and trained service of the public library of your community? The function of the business library is to supplement that of the public organization and to provide a clearing house of live information within a company where even confidential problems can be effectively met. This is the second of a series of articles by the librarian of H. M. Byllesby & Company of Chicago which aim to show not only how the large company may best meet its problems of records, but how the smaller ones may properly file and catalog needed material. Attention is called to the necessity for written permission in reprinting these articles.—The Editor.)**

## COORDINATION OF THE BUSINESS LIBRARY WITH PUBLIC LIBRARIES



The Business Branch of the Newark Library with a show window used for displaying its resources.

AFTER the resources for information which exist within the business organization have been adequately centralized as briefly described in the previous issue of the Journal of Electricity, the next important step is to coordinate these resources with all other existing library facilities of the city in which the business firm is located. There should be a thorough survey of these libraries in order to ascertain as far as possible the content and availability of their resources. This is an important factor in the creation of a business library, when one considers the problem of shelving much material, within the more or less limited space occupied by a business organization. Floor space in skyscrapers is too valuable to be used as a mere storehouse for printed material used only on rare occasions, and there is also the added expense of a staff of workers to care for a large collection. The business library must, therefore, be considered solely as a working laboratory, and care taken not to include in it material which will be seldom used, particularly in cities where business organizations congregate, and where are located large public libraries having excellent resources which can be used to supplement the "working laboratory" collection of the business organization.

**BUSINESS MEN IN THE NEW YORK LIBRARY**

This is a small room in the Economics Division of the New York Public Library accommodating about twenty-five readers to which business men and investigators are permitted to bring their own typewriters, dictating machines and stenographers. Books and other material are reserved for indefinite periods for those to whom a seat is assigned.

**THE LIBRARY IN USE**

One of the busy days in the John Crerar Library of Chicago. This is the middle of the afternoon—but the reading room is in active use by business men.

This principle will not apply, however, to those business libraries which are maintained at the headquarters of national associations. Such libraries must collect everything on their subjects, and be prepared to be a central bureau of information on their specialties, for their membership throughout the United States. For example, the libraries of the National Safety Council and the Portland Cement Association, located in Chicago.

This policy of coordination was expressed in the following words, by a large corporation several years ago when it organized its library: "We will keep our library down as far as possible to a small working collection, and our librarian shall be a go-

VISIT a war hospital — then do your part

—Victory Loan

between us and the other libraries of the city when we want information not available in our own collection." Thus the busy man of affairs is able to keep in touch, through his librarian, as proxy, with many avenues of helpfulness, which would be closed to him were it not for the fact that he had been farsighted enough to employ a librarian to act for him in these matters of detail.

Public library facilities, while they supplement can never be a substitute for a library within a business organization, for different groups of business people who are vitally interested in one particular subject, or more often in only one phasee of a sub-

A BUSINESS LOCATION IN THE BUSINESS DISTRICT
This is just one corner of the Business Branch of the Free Public Library of Newark, N. J., showing their collection of directories

ject, will naturally collect and know more about that subject than a general library serving a thousand and one interests can be expected to do.

The business librarian who is given the confidence of the officers of his organization, gets saturated with a knowledge of the business of the organization and is able to sense in advance what information will be needed, and will be prepared as far as possible for the emergency when it comes.

All librarians of public libraries will undoubtedly agree to the statement that they are not in a position to act as confidential library adviser to rival business corporations. The Public Library must deal impartially with all inquiries and cannot give precedent to any inquirer simply because he is in a hurry. Every man must wait his turn because the needs of other inquirers are equally important with his.

If the Utopian state should ever arrive when our public libraries have all the money necessary to meet the every information need of the community, the argument that the public library should serve the interests of business men, who are tax payers, in such a manner that it would not be necessary for them to have libraries within their business organizations, can be answered by a parallel suggesting that the public library should serve all the interests of the public that no one need have a library in his own home. A business organization desires to make its own selection of material, on the basis of its needs and tastes; it wishes to have this material close at hand without any borrowing restrictions, so that it can be used quickly, without loss of time, and without the limitations which would be imposed if it were the property of some one else, and required particular care to keep it intact, for the business man often wishes to clip or give away the printed information in his possession.

The business library is, however, not antagonistic to the public library at any point. On the contrary, the business library must coordinate its resources with those of the public library and work in harmony with it.

The large business organization which can afford to employ a librarian, and the small business firm which cannot, will find a wealth of helpful material in the public libraries of their vicinity and this material will be noted in detail in future articles in this series.

Many of the smaller public libraries which are not large enough to maintain special business departments are giving most excellent service to business men. A number of the large public libraries of the country are making a specialty of serving business needs through departments organized particularly to serve business men. Some of these are the Division of Economics and Documents of the New York Public Library, the Business Men's Branch of the Free Public Library of Newark, New Jersey, and the Industrial Department of the Los Angeles Public Library. The John Crerar Library of Chicago is a free reference library covering sociology and natural and applied science, which cannot be excelled by any other library collection in the United States in the facilities which it offers to business men. Every business organization should get acquainted with the public library of its city and ascertain what that library is able to do for it.

### The Cost and Value of the Business Library

The cost of maintaining a business library is in no sense comparable with its value; for the help which a business library may give in a single instance is often of sufficient value to offset its cost of maintenance for a whole year. For example, a business firm had a law suit in a distant city and sent one of its employes to give expert testimony in the case. This employe found as the hearings in the case progressed, that he could strengthen his testimony if he had at hand figures showing the market price of lead for the past ten years. There was no time to spare in obtaining these data. He sent a telegram to the home office, which was received at 11:30 A. M. saying that he would call them by long distance telephone at noon and to have the figures ready. The head of the department to whom the message was addressed, with some perturbation, appealed at once to the librarian of the company, who was able in ten minutes to produce a table giving a summary of the prices desired, which had been printed in a technical journal. The company won the law suit and in comparison with the large amount of money saved, the salary of the trained librarian who knew how to meet the emergency, was a very small item.

No two business libraries are comparable as to cost of maintenance. Each must allow for financing

on the basis of its individual needs and the money it can afford to spend.

If a business firm owns the building which it occupies it does not have to consider the rental of floor space for the library. If it has a liberal policy of advertising in the best technical or trade journals, it will need to spend very little on periodical subscriptions, as it will receive copies free on account of advertising. If it is a liberal user of the publications of the United States Government, it will find they cost little or nothing, and in any case the amount spent by business libraries for information special to a particular industry, is never very large, because often the most valuable data cost practically nothing to secure. Mechanical equipment, which will be discussed in detail later in this series of articles, is largely the initial expense, and the amount of money to be spent each year for additions to the original equipment, will be quite small. The principal annual expenses in maintaining a business library are the salaries of the librarian, and assistants if required, and the additional expense of stenographic and office boy service.

The great mistake made by some business firms in maintaining library service has been the employment of inadequately trained librarians who do not produce high grade results. The writer saw, sometime ago, the sorry spectacle of one of the largest corporations in the country trying to inaugurate library service under the direction of a fourteen-dollar-a-week file clerk who had not a single educational requirement necessary for the success of the undertaking. Such firms generally proclaim business library work a failure instead of admitting they have made a wrong start and that they should have employed a high grade trained librarian. What the essential qualifications for successful business librarianship are, will be stated in a special article in this series.

In conclusion, it should be said, that in establishing library service, a business organization must be willing to give such service a reasonable length of time to grow into the work of the organization. A wisely selected collection of material, adapted to the needs of the business, and thoroughly organized, to give quick and accurate results, should be tested just as a piece of machinery is tested, namely, set up the apparatus, put it in full operation under competent supervision, and in the case of the business library the verdict cannot but be—"it works."

# PRACTICAL LESSONS IN ELECTRICITY

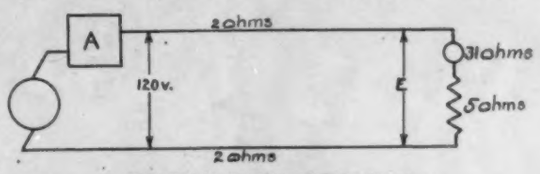
BY H. H. BLISS

**(A practical course in electricity is advocated elsewhere in this issue as a necessary part of an electrical salesman's training. Here is just such a practical course provided by the Extension Division of the Universities of California and Oregon, for which the Journal of Electricity is used as a text. The author is in charge of the technical extension instruction for the University of California. This is the second article—but for those starting the course late, all previous articles will be furnished.—The Editor.)**

## SERIES AND MULTIPLE CIRCUITS

**Series Circuits.**—Many electric circuits consist of several different parts through which the current passes in **"series."** This means that the electricity must go through one part after another. Make a clear distinction between this arrangement and the **"multiple"** circuit in which the current divides and flows through several branches. Fig. 1 illustrates the first and Fig. 2 the second type.

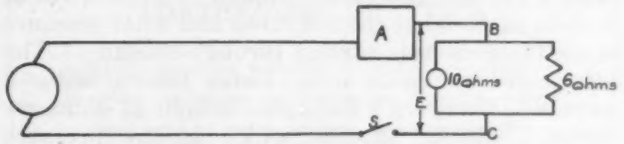
What is said about these applies to direct current circuits and also to those alternating current




**RESISTANCE IN SERIES—Fig. 1.**
In spite of the varying resistance of the various elements of the circle, the current passing through each is the same—3 amperes.

circuits which contain only simple resistance and no electromagnetic apparatus or condensers.

The current leaving the generator in Fig. 1 goes first through an ammeter, then through the upper wire, then through a lamp, then through a resistance coil, and finally back to the generator through the lower wire. It is obvious that if 3 coulombs per second (3 amperes) pass through the generator to the ammeter, the same number must travel along the upper wire through the lamp and the coil and back to the generator through the lower wire. If any more coulombs passed out through the ammeter




**RESISTANCE IN MULTIPLE—Fig. 2.**
The current divides between the lamp and the resistance coil, 3 amperes being carried by the one, 5 by the other.

than came back through the lower wire there would be an accumulation of electricity somewhere in the right hand part of the circuit; if any more returned to the generator than left it there would be a production of coulombs somewhere in the right hand part of the circuit. Both of these alternatives are

**VALUE your honor — pay your bills**

**—Victory Loan**

In this park in Portland, Oregon, 50 lamps of 400 candle power each are connected in series. The lamp at the left of the center takes 6.6 amperes; how much is taken by the lamp farther along the walk? The voltage across each lamp averages 37 volts; what is the drop in the line wires if the current leaves the substation at 1880 volts? What is the resistance of the line and of each lamp?

impossible with this apparatus and hence we conclude that:

In a series circuit **the total ohms = the sum of same everywhere.**

If a resistance of 2 ohms is in a series of another of 3 ohms, the electromotive force must overcome 5 ohms in sending current around the circuit. If we apply 20 volts the amperes will amount to $20 \div 5$ or 4.

In a series circuit **the total Ohms = the sum of separate resistances.**

To find the voltage across each one of the resistances in the previous example we apply Ohm's Law as usual: $4 \times 2 = 8$ volts across one, and $4 \times 3 = 12$ volts across the other. Across the whole combination the pressure = 4 amps. $\times$ 5 ohms = 20. This result is also found by adding the two voltages 8 and 12.

**Pressure across a series of resistances equals sum of the voltages across the separate resistances.**

In Fig. 1 a lamp of 31 ohms resistance is in series with a coil having 5 ohms. Current is supplied from a 120 volt generator through two line wires of 2 ohms each. What current flows and what pressure is used to force this current through the lamp? The total resistance is 40 ohms. Hence the current = 3 amperes. To drive 3 amperes through 31 ohms requires $3 \times 31$ or 93 volts, which is the pressure across the lamp.

**Voltage Drop.**—In this example we find the pressure across the lamp considerably lower than that supplied by the generator. There has been a drop in the voltage from 120 to 93, or 27 volts. This may also be calculated by Ohm's Law. The resistance of the circuit between the generator and the lamp totals 9 ohms. The pressure necessary to force the 3 amperes through this is, of course, $3 \times 9$ or 27 volts.

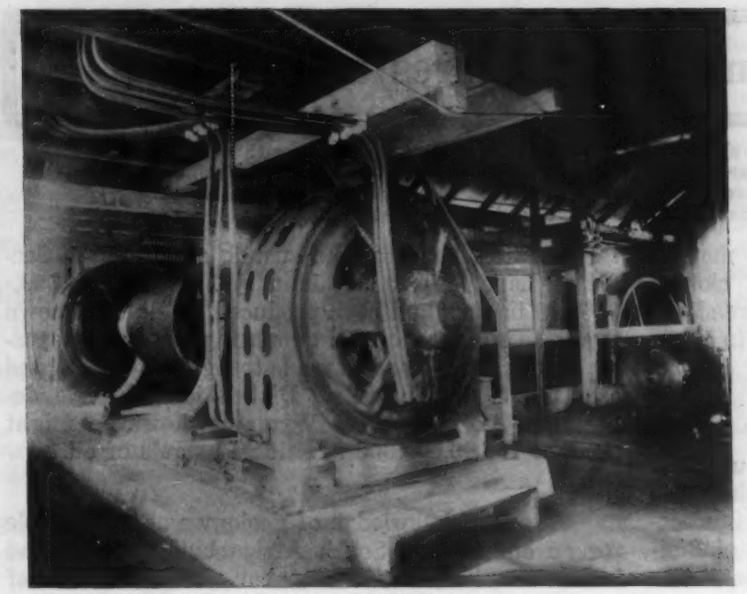
**The voltage drop in any conductor equals the pressure required to force the current through its resistance.**

The drop between a generator and its load depends, then, upon both the line resistance and the number of amperes.

**Resistances in Multiple.**—When several lamps are located in one lighting fixture they are generally not connected in series with each other. Though they are all governed by one wall switch, any lamp can be burned out or unscrewed without affecting the others. In a series circuit this could not be done.

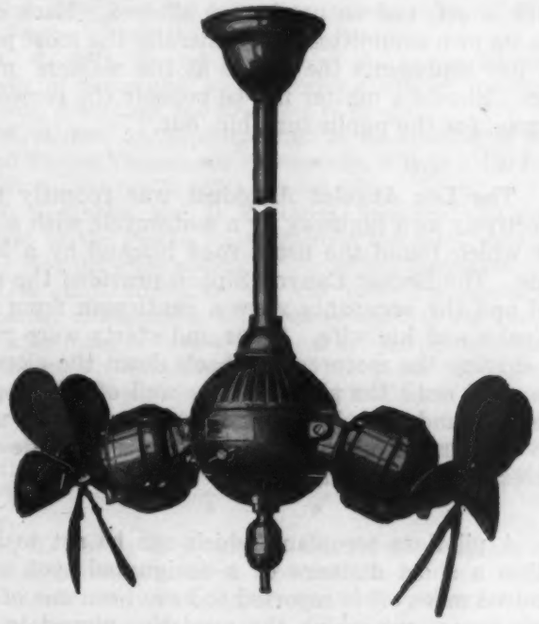
In Fig. 2 we have a simple example of two resistances, a lamp and a coil, connected in "multiple" with each other; that is, connected so that the current flowing through the ammeter divides and part goes through the lamp and part through the coil. Either can be disconnected without stopping the current in the other. This arrangement is sometimes spoken of as a "shunt" connection or a "parallel" connection.

This municipal Christmas tree in a California city was lighted by 70 lamps in parallel. Each lamp took .23 ampere and the circuit voltage was 110 at the tree. The current was brought from a transformer on two wires of .12 ohm each. Can you calculate the resistance of each lamp, the combined resistance of all of them, the voltage drop in the wires and the voltage at the transformer?



**Two 400 horse power motors are connected in multiple on the same power circuit. They are furthermore "direct connected" to the same shaft, so that the load is divided equally between them and the motors take equal currents. They lift the mine hoist at the South Eureka gold mine on the Mother Lode in California.**

Suppose that there is a pressure of 30 volts between the line wires at point E, close to the load. This is a measure of the effort to send current through the lamp and, if the lamp has 10 ohms resistance, it will carry a current of 3 amperes. The same pressure tends to send current through the coil, and, if that has 6 ohms, it will carry 5 amperes. The ammeter will read the sum of these two currents, 8 amperes.



These two fans operate in multiple on the same circuit. Hence either can be turned off without stopping the other. If the line current is 5 amperes at 110 volts when both are operating, what is the voltage and amperage for each motor? What is the resistance of a heater which takes as much current as three fan motors?

In a multiple circuit **the voltage is the same across every branch; total current equals the sum of the branch currents.**

**Combined Resistance.**—As the combination of resistances shown in Fig. 2 takes more current than either one alone, we realize that the combination offers less resistance to current flow than either of its parts. Considering the lamp and coil as united into a piece of apparatus with terminals at B andC, we may compute its resistance from Ohm's Law as volts ÷ amperes : $30 \div 8 = 3.75$ ohms.

A standard way to calculate is to assume one volt applied to the circuit, add the currents which would flow, and divide their sum into the one volt. Trying this on Fig. 2 we have $1/10 + 1/6 = 16/60$, the combined current. The resistance $= 1 \div 16/60 = 60/16 = 3.75$ ohms.

In a multiple circuit **combined resistance is less than ohms in any one one branch; combined resistance = 1 ÷ sum of reciprocals of branch resistances.**

## FOURTEEN RULES FOR ELECTRICAL CONTRACTING PRACTICE

The following Code of Practice is recommended to architects, consulting engineers, contractors and owners as well as owners' engineers, by the National Association of Electrical Contractors and Dealers, the Executive Committee of which adopted and approved it as a step toward the standardization of many practices in connection with the original contracts and those for extras which, unless definitely settled in advance, leads to misunderstanding on both sides and frequently to controversies and litigation. The National Association does not, however, attempt to bind its members to use this code, but respectfully submits same for the approval of both customers and contractors.

**Rule XII. A fair price will be charged for drafting or engineering services when the contractor is called upon to render such services.**

**VOLLEYS of bonds to back the boys**

**—Victory Loan**

# SPARKS—Current Facts, Figures and Fancy

(Two hundred dollars for a pair of shoes makes us feel a little better pleased with our own war prices. The telephone in the war zone, felt from spun glass, watering weeds, building railroads of mercury and various other items of special interest, in war and peace, are further included in this brief survey of odds and ends in electrical news.—The Editor.)

Here are some prices in Russia: Six months ago sugar was $12.00 a pound, a suit of clothes $800.00, a pair of shoes $200.00, a loaf of bread $6; and, if you had not money enough to buy in these wholesale amounts and chose to buy sugar by the lump, each lump cost 50 cents.

* * *

Felt made from spun glass is said to be used for insulators in storage batteries in Italy. Cloth is also produced from this substance, which is manufactured after a process invented by Signor Luigi Bisigato of Venice. A new society, the "Vitrum," has been formed, with extensive plants at Naples, for its manufacture.

* * *

The number of telephones in use in the United States at the close of the calendar year 1917 was 11,713,228—one to every nine persons, or every two families; and the number of calls made during the year is estimated at 21,842,000,000, an average of more than two hundred for every man, woman, and child in the country.

* * *

It is stated that 5,000 miles of telephone wire were laid in the St. Mihiel salient and along its borders by the Americans before their attack on the salient. When the battle opened trucks laden with wires started north, unreeling the wires through No-Man's-Land, and 6,000 telephone instruments were used to connect these wires in the battle zone.

* * *

Verily there is a use for everything. Noting that no vegetation grows around Owens Lake, California, because of the chemicals contained in the water, the Southern California Railroad has hit upon the scheme of filling oil cars with the lake water and sprinkling it along the right-of-way on the San Joaquin Division, thereby effectually and inexpensively killing the weeds which are the bugbear of the maintenance expert.

* * *

There is a very serious rice shortage in South China and the Far East generally, and so far as the South China field is concerned, nothing short of a rice famine is in sight. The situation is further complicated by the fact that owing to the high price and short supplies of wheat flour and other breadstuffs, there is nothing to take the place of the rice in food for the native population. The situation in Japan is such that already riceless days have been instituted.

* * *

Forty per cent of the total known oil supply in the United States, exclusive of oil shale deposits in three states, has been exhausted, according to Secretary Lane. Up to last January 1 a total of 4,598,000,000 barrels had been produced, while the known available oil resources, not counting the shale deposits, in the ground and in field storage were estimated at 6,740,000,000 barrels. Distillation of shale deposits in Colorado, Utah, Wyoming, however, might produce 70,000,000,000 additional barrels of oil.

* * *

A lack of knowledge of geology was responsible for an engineer in South Africa building the road bed of a railway out of cinnabar. This is the chief ore of mercury and exceedingly valuable. The cinnabar remained there with the trains running over it until found by accident by a mining expert, who, looking out the carriage window, noted the brilliant color with something unusual about it and went back to examine it.

* * *

Here is a description of life in a Russian school under the Bolshevist regime: "Pupils do exactly as they please, even walking in and out in the middle of a lesson. No punishments are inflicted, no home work is set, and no marks are allowed. Each class has its own committee, and generally the most popular boy represents the others at the masters' meetings. Should a master not be popular the remedy is simple, for the pupils turn him out."

* * *

The Los Angeles Aqueduct was recently used effectively as a highway by a motorcycle with a side car which found the usual road blocked by a landslide. The Boquet Canyon Siphon provided the road bed and the occupants were a gentleman from Los Angeles and his wife. Stops and starts were made by driving the motorcycle wheels down the slope of the steel until the side car was well off the top of the pipe and then lowering the side car weel until the tire rested on the steel surface. The ride was successfully accomplished.

* * *

A pilotless aeroplane which can be set to land within a short distance of a designated spot some hundred miles off is reported to have been one of the war's inventions which the armistice nipped in the bud. Secretary Baker in a recent address told of an airplane which went out under control of a pilot without making a landing, returning to its point of origin after locating the distant objective for the test. Another aeroplane was then sent out under automatic control to land at the designated point, and it effected the landing so close to that point that had it been a shell it would have been considered a good shot.

# PERSONALS

**A. D. Page** of the Edison Lamp Works will attend the Coronado convention.

**A. H. Jackson** of the law department of the General Electric Company is a recent San Francisco visitor.

**Gerard Swope,** recently appointed president of the International General Electric Company, is on his way to the Orient.

**Stephen T. Mather,** director of national parks for the United States, spent several days in San Francisco recently en route to Hawaii.

**Capt. Arthur F. Bridge,** formerly of the engineering staff of the California Railroad Commission, has returned to San Francisco from France.

**W. R. Herstein,** secretary and treasurer of the Electric Supply Company, Memphis, Tenn., and Mrs. Herstein were recent visitors in California.

**H. C. Ross** has transferred from the commercial department of the Pacific Gas & Electric Company at San Francisco to the Fresno district.

**Charles Matthews,** who installed the electric range equipment at Camp Curry, Yosemite Valley, has taken charge of electrical operations at Camp Curry.

**R. C. W. Libbey,** representative of the Simplex Electric Heating Company, is visiting the Pacific Coast preparatory to establishing new offices in the West.

**J. R. Baker,** auditor for the Incandescent Lamp Committee of the General Electric Company, New York, is visiting Seattle and other Northwest centers.

**Armiger F. Dredge,** son of Theo F. Dredge of San Francisco, has been promoted to master engineer with the 33rd U. S. Engineers with the A. E. F. in France.

**L. R. Cady,** general manager of the Lassen Electric Company of Susanville, an enterprising city of Northern California, is a recent San Francisco visitor.

**W. G. Ely, Jr.,** superintendent of construction of the General Electric Company at Schenectady, is to be a California visitor. His family will accompany him.

**T. E. Bibbins** and **D. E. Harris,** president and vice-president of the Pacific States Electric Company, were in Seattle recently while making a tour of the Northwest.

**Lieut. E. B. Strong, Jr.,** who was formerly a member of the Journal of Electricity staff, has returned to the Pacific Coast after being in France but is not yet out of the service.

**George N. Rooker,** manager of the Richmond, California, division of the Western States Gas & Electric Company, has been elected a director of the local chamber of commerce.

**Geo. A. Hughes,** president of the Edison Electric Appliance Company, Inc., together with Mrs. Hughes will visit the Pacific Coast in April and attend the Coronado convention.

**S. M. Murray** of the Illinois Electric Company has returned to Los Angeles after attending the meeting of the Electrical Credit Association of the Pacific Coast at San Francisco.

**C. G. A. Baker,** general manager of Baker-Joslyn Company, with headquarters in San Francisco, has returned to his home office after an extended visit to his branch houses in the Northwest.

**L. Gibson,** manager of production of the Schenectady works of the General Electric Company, is visiting the Pacific Coast. Mr. Gibson is a brother of Charles Dana Gibson, the well known artist.

**Frederic P. Vose,** secretary of the National Electrical Credit Association, was in San Francisco recently in attendance at the annual meeting of the Electrical Credit Association of the Pacific Coast.

**S. L. Whitestone,** general auditor of the General Electric Company with headquarters in Schenectady, and Mrs. Whitestone passed through San Francisco en route to the Orient for an extended vacation.

**Samuel T. Wellman,** president of the Wellman-Seaver-Morgan Company of Cleveland, Ohio, is a recent San Francisco visitor. Mr. Wellman is a past president of the American Society of Mechanical Engineers.

**E. W. Rockafellow,** manager of the supply department of the Western Electric Company with headquarters in New York City, is expected to attend the Coronado conventions the latter part of April and first of May.

**A. L. Menzin,** who was formerly located on the Pacific Coast and who has been practicing industrial engineering during the past five years with office in Philadelphia, has opened an office in the Monadnock Building, San Francisco.

**T. V. Halsey** was recently elected vice-president and director of the Philippine Telephone & Telegraph Company to fill the place of F. W. Eaton, who died during the year. The company's annual statement has not yet been received from the islands.

**A. J. Turner,** a well known construction engineer in the Pacific Northwest, has been named engineer of the Columbia basin commission to be in full charge of the engineering features of the preliminary survey which the commission is about to launch.

**Dr. J. A. L. Waddell,** now of Kansas City, Mo., one of the builders of Portland's lift bridges, has been elected a member of the French Academy of Science, the highest honor an engineer can achieve. Dr. Waddell is one of only 10 Americans who have ever won such honor.

**W. L. Goodwin,** of the General Electric Company, plans to attend the convention of Westinghouse Agent Jobbers at Del Monte where he is to be a speaker on the program. He will also attend the Coronado conventions and bring again his message of cooperation to the electrical industry of the West.

**George Mackenzie Brill,** consulting engineer for the U. S. Shipping Board, is a recent Portland, San Francisco and Los Angeles visitor. Mr. Brill's task is to appraise the ships in American ports taken over from Germany during the war. He is a past vice-president of the American Society of Mechanical Engineers.

**E. A. Batwell** is to continue with the Puget Sound Traction Light & Power Company, at Seattle, notwithstanding the sale of the street car system of the company to the city. He retains his title of publicity agent and will also continue as editor of the Puget Sound Electric Journal which is the house organ of the district.

**Dr. B. Okazaki,** civil engineer of the department of Home Affairs, Imperial Japanese Government, and formerly chief engineer of the Ishikari River Improvement Works, is a recent Pacific Coast visitor. Dr. Okazaki has visited in California all of the big dams now under way including the Calaveras, and the Otay near San Diego.

**Paul H. Manchester,** formerly with the Pacific Gas & Electric Company, has arrived in San Francisco with the Engineers returning from France. Mr. Manchester saw service with the heavy artillery and has many interesting experiences to relate, including the experience in which he lost the hearing of an ear due to the roar of the heavy artillery.

**S. B. Anderson,** treasurer of the Pacific States Electric Company, called a conference of the company's several assist-

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**VARIOUS excuses pay no bills**

**—Victory Loan**

ant treasurers at San Francisco prior to the meeting of the Electrical Credit Association of the Pacific Coast. Attending this meeting were **Roy Worth** of Seattle, **H. R. Olsen** of Portland, **H. C. Chapman** of Los Angeles and **C. W. Goodwin Jr.** of San Francisco.

**C. E. Grunsky,** consulting engineer, with headquarters at San Francisco, has left for a business trip to New York, Chicago and Washington. On his way home the latter part of the month he hopes to attend the gathering of engineers to be held in Chicago in the interest of forming a national department of engineering, in which he has taken an active part for some time past.

**Harry C. Kendall,** formerly traffic engineer for the Portland Railway, Light & Power Company, has returned to Portland to become associated with the Lumbermen's Trust Company. Mr. Kendall has for the past year been connected with the Emergency Fleet Corporation in the negotiations with public utility companies for improved facilities and with the Delaware river district as engineer.

**James B. Black,** salesmanager of the Great Western Power Company, **Gaskell S. Jacobs,** of the engineering staff of the California Railroad Commission, and **R. M. Alvord,** local supply manager of the General Electric Company, accidentally ran across each other lately at one of the well known hospitals in Oakland to find each was to be congratulated upon being the proud possessor of the title of "father."

**George W. Goethals,** builder of the Panama Canal, to whom an issue of the Journal of Electricity was dedicated some time ago, has recently been awarded the John Fritz Medal by the National Societies of Civil, Mining, Mechanical and Electrical Engineers. The medal has previously been awarded to Lord Kelvin, George Westinghouse, Alexander Graham Bell, Thomas A. Edison, Charles T. Porter, Alfred Noble, Sir William Henry White, Robert W. Hunt, John Edson Sweet, James Douglas, Elihu Thomson, Henry M. Howe and J. Waldo Smith.

**Robert Sibley,** editor of the Journal of Electricity, has been asked by the Extension Division of the University of California to deliver the lecture before the Foreign Trade Club of San Francisco, April 23, 1919, on the subject: "Foreign Trade from the Engineer's Viewpoint." Mr. Sibley will combine his knowledge of western engineering progress with the results of a personal survey made by him in the Orient on matters pertaining to engineering development. He will conclude by showing that certain principles that are being enunciated by the California Electrical Cooperative Campaign present the best means of bringing about effective and remunerative international commercial and engineering relations with our foreign neighbors. The Foreign Trade Club of San Francisco is composed of five hundred men and as a consequence admission to the lecture will have to be limited to members only, except by special invitation.

### OBITUARY

Robert E. Twohy, vice-president of Twohy Brothers of Portland, active head of the large railway construction firm and associated in all of the extensive Twohy interests, died at San Francisco recently. Although but 28 years of age Mr. Twohy was president of the California & Oregon Coast Railroad, which operates from Grants Pass to Crescent City, and was looked upon as one who would have achieved national prominence.

# California Electrical Cooperative Campaign

**(The California Electrical Cooperative Campaign has won the approval of merchants in every section of the state for the practical nature of its assistance. It is now broadening its work by adding a new field agent in the southern district. Below is given an expression of approval from one who has worked alongside the campaign representatives—and a sample of some of the work of the campaign.—The Editor.)**

**A. L. Spring,** the first Field Representative employed by the Committee in January, 1918, was for many years in the employ of the Western Electric Company, part of the time being assistant manager of their Los Angeles office branch. He covers that part of California that lies south of the Tehachapi, his territory on the coast extending to just north of Santa Barbara. The Advisory Committee in charge of the Campaign has arranged for the four Field Representatives to attend the conventions which will be held at Coronado, week ending May 3rd, in order that the electrical men in California may become better acquainted with these Field Representatives, and in order that the Field Representatives may be able to carry back to their respective territories for the benefit of those unable to attend, some of the good ideas developed in the discussion at the convention.

**W. F. Brainerd,** the second Field Representative employed by the Committee, was for several years a successful commercial representative of the Hotpoint Heating Company. He entered the employ of the Campaign Committee in March, 1918, and now covers all that portion of California north of Tehachapi, which is covered by Campaign activities, except that in the vicinity of San Francisco bay, which is covered by C. C. Davis. It has not yet been considered advisable to extend the travels of the Field Representatives into the sparsely settled districts of the state, where traveling expenses are high.

**C. C. Davis,** the third Field Representative employed by the Committee, commenced Campaign work in February, 1919, covering the following territory: Contra Costa county, Alameda county, Marin county, San Francisco county, San Mateo county, and Santa Clara county south to and including San Jose. Mr. Davis was for several years the Wiring Device Specialist of the General Electric Company at San Francisco, and more recently was manager of the Electrical Department of the Baker-Hamilton-Pacific Company, one of the leading wholesale hardware concerns in San Francisco.

**Lieut. S. A. Sharpe** commenced work as Field Representative for the Campaign in the middle of March, 1919. Lieut. Sharpe, who is a technical engineer, U. S. Air Service, has just returned from service overseas. Prior to his enlistment in the army service, Lieut. Sharpe received considerable technical training and practical experience in the electrical field through his employment by various concerns in New England and the Southwest. He comes to his new work well equipped to carry it on successfully. He will act as assistant to Mr. Spring in the southern section, paying particular attention to the electrical contractors and to electrical contracting problems. This move comes appropriately at a time when home building and home wiring campaigns are being carried out as a national feature.

**FIELD AGENTS OF THE CALIFORNIA ELECTRICAL COOPERATIVE CAMPAIGN**

## MAKING BETTER MERCHANTS

### A Comment on the California Electrical Cooperative Campaign

Through the efforts of the local Field Representatives A. L. Spring and his assistant, F. A. Sharpe, the electrical contractor-dealers have been brought together under on organization with a slogan, "Better Merchandising."

Today when you walk into any live electrical contractor-dealer's store you find a real merchandising institution.

A good example of the help and cooperation given by the Field Representatives was brought out by Mr. Farley of the Reed-Farley Electric Company of Fullerton and Anaheim. Mr. Farley is very enthusiastic over the assistance given him when planning his new store in Anaheim, and made the following remark on opening day:

"We really feel we owe the California Electrical Cooperative Campaign a great deal for their splendid assistance in planning our new store. The suggestions given us for our store arrangement and window trim have proven a great help and we feel confident these ideas will be a big help in building up our business."

The contractor-dealers in Southern California are very enthusiastic over the help given them by the Field Representatives and all admit the California Electrical Cooperative Campaign has been a big factor in building up their business by helping them use better merchandising methods.

CARL HEINTZ,
Promotion Dept., Westinghouse Electric & Manufacturing Co., Los Angeles.

## THE DEALER AND THE ELECTRIC RANGE

BY A. L. SPRING

The time is not far distant when the electrical dealer will be an important factor in the sale of electric ranges. In fact, in Southern California several dealers are now actively pushing the sale of ranges and more are contemplating doing so. Mr. D. Coldren of Coldren's Electric Shop, Riverside, California, has been for the past year aggressively selling ranges and has been the most successful of the dealers in this section.

First a capable range solicitor for two weeks made house to house calls on likely prospects and introduced the idea of electric cooking. The solicitor told of a demonstration that was to be held at the dealer's store and invited them to be present. Effective newspaper advertising announced the demonstration to the public and advised when and where it would be held. This demonstration was carried on for one full week by a competent lady demonstrator in the employ of the manufacturer and each afternoon and evening she also give a lecture on electric cooking. The demonstration and the lectures were well attended and a number of good prospects were secured.

A meeting was then held with the employes of the municipal plant at which they were properly instructed regarding electric cooking, were advised of the campaign and their cooperation was obtained.

The range solicitor, assisted by factory specialists, then carefully followed up the prospects secured at the demonstration and orders began to come in. When a range was sold the demonstrator called and instructed the user how to efficiently operate it. The ranges were sold at list prices on terms of 30% down and balance in six monthly payments, or for cash at list prices less a discount of 3%, and in each installation charges were made which carried a fair profit to the dealer.

During the year the range solicitor was employed for six months and about $300 was spent in newspaper advertising. Water heaters and air heaters were sold whenever possible and the result of this dealer's first year of activity on ranges was the sale and installation of forty-one ranges, ten large water heaters and seven installations of high wattage air heaters.

That the campaign was properly handled is proved by the fact that not one range has been taken out and there is not a single dissatisfied customer. The average monthly bill on the three cent rate has been less than three dollars. The dealer more than broke even on his first year of selling ranges and 1918 was certainly not a good range year. From now on this business will net the dealer a good profit and his entire business will benefit by the advertising the campaign has been to him, and due to the efforts of the dealer the central station will receive about $2500 a year additional revenue.

## IMPROVING THE APPEARANCE OF THE STORE

BY A. L. SPRING

It is often a problem to the dealer to know what to do to improve the appearance of a bare wall in his store. The San Diego Gas & Electric Appliance Company has solved the

One of the advertising cards in a simple frame

problem; they have made a bare wall attractive and at the same time have turned it into a good advertising medium. Manufacturers' advertising cards have been framed and hung on the wall like pictures as shown in the accompanying illustration. These cards can easily be removed from the frames

The bare walls of this store have been greatly improved in appearance by framing some of the attractive advertising material provided by manufacturers.

and new ones inserted so that if the dealer desires the cards can at all times advertise articles in season.

In my work as representative of the California Electrical Cooperative Campaign I have offered this suggestion to a number of dealers whose stores needed something of this kind. The accompanying cut shows a close-up of a street car card framed by Snyder & Bell, dealers in San Bernardino to whom the suggestion was given. They have made the frame of surfaced one-inch by two-inch redwood and have sprayed it gold with their fixture spraying apparatus.

There is no need of glass in front of these cards and frames are inexpensive.

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**VISIBLE support is what is needed**

**—Victory Loan**

# Meeting Notices for Electrical Men

**(The outstanding feature of this issue, of course, must be the plans for the coming Coronado Conventions. Several other meetings of particular interest, however, have taken place during this two weeks period and are here reported. The annual meeting of the Electrical Credit Association of the Pacific Coast was one of these pleasant occasions. Extensive plans are under way for a successful meeting of the Westinghouse Agent-Jobbers at Del Monte. —The Editor.)**

### San Francisco Section, A. I. E. E.

At a meeting of the San Francisco Section, A. I. E. E., held at the San Francisco Engineers' Club rooms on Friday evening, March 28, 1919, a paper on Railway Electrification by W. F. Dietrich, which was published in the Journal of Electricity for Nov. 15, 1918 and March 1, 1919, was read. The paper represented the results of research by the National Fuel Administration during the war period, and has proven of wide interest. The Institute meeting was well attended and intensely interesting discussion took place. Those who participated in the discussion were Professor J. C. Clark, Stanford University; E. A. Palmer, Westinghouse Electric & Manufacturing Co.; W. J. Davis and A. V. Thompson of the General Electric Co.; F. H. Fowler, of the Forest Service; L. R. Jorgensen, consulting engineer; J. E. Woodbridge, Sierra & San Francisco Power Company; W. G. Vincent, Pacific Gas & Electric Company, and Robert Sibley, editor of the Journal of Electricity. At the conclusion of the meeting the following resolution was unanimously adopted:

"Resolved, That it be the sense of this meeting of the San San Francisco Section of the A. I. E. E. devoted to the discussion of railway electrification, that a committee of eleven be appointed by the chairman of this section to investigate the problem of railway electrification and report to this section from time to time such data as may become available for offering definite conclusions on the subject of railway electrification.

"Resolved, furthermore, That this committee should have the following constitution of membership:

1. A representative of a power company.
2. An independent consulting electrical engineer.
3. A representative of the electrical engineering staff of a prominent transcontinental railway.
4. A representative of the electrical engineering staff of the Pacific Telephone & Telegraph Company.
5. A representative of the engineering staff of the California Railroad Commission.
6. A representative of the electrical engineering staff of the Forest Service.
7. A representative of the electrical engineering staff of the faculty of the University of California.
8. A representative of the electrical engineering staff of the faculty of Leland Stanford Junior University.
9. Three representatives at large.

Furthermore be it resolved, That in making his appointment the chairman be urged to appoint only such representatives on this committee as are willing to offer their services as a contribution to the good of the profession and are willing to put a reasonable amount of time into the problem to arrive at thorough and reliable conclusions."

### Oregon Electrical Contractors and Dealers

The regular meeting of Oregon Electrical Contractors and Dealers for District No. 1 was held at the Imperial Hotel, Monday, March 24, 1919.

The Executive Committee reported having held meetings and being now established in the new offices of the association, and recommended to the meeting that it was the consensus of opinion of the Executive Committee that the members were not close enough and did not display enough enthusiasm in the association work and that as the future seemed to be an era of much construction and prosperity, some means should be devised whereby the members could become more enlightened in the matter of submitting bids and the proposition of conducting a more open association, somewhat along the line laid out by Arthur Jerome Eddy in his work entitled "The New Competition." There was considerable discussion and the Executive Committee was instructed to proceed along this line and to endeavor to get results.

The State of Association committee reported in detail of its efforts in securing for the contractor-dealer the business which, in their opinion, he was entitled to, where now competition with the wholesaler exists. The committee reported quite extensive plans of action and said that it would take some time for the accomplishment of all it was seeking. The chairman asked the members to go on record in regard to their purchases of electrical supplies and material, and asked if the committee was successful in obtaining results, if they would pledge themselves in their purchases to patronize home industry and jobbers and wholesalers with established places of business in this territory.

It was moved and seconded that the secretary be instructed to see all the members in regard to this matter. The applications of the Sellwood Electric Supply Co. of Portland and the Standard Electric Co. of McMinnville, members of this district, were submitted and they were unanimously elected.

### BUILDERS OF THE WEST—LI.

COLONEL H. M. BYLLESBY

**As the president of seven great utility companies, the vice-president of three others, and a member of the directorate of seventeen companies in all, Colonel H. M. Byllesby has added to the utility life of the nation a distinct type of helpfulness achieved by no other individual in the evolution of efficient and economic utility service. To Colonel Byllesby —the executive, the soldier and the citizen—this issue of the Journal of Electricity is affectionately dedicated as a memorial to his lasting and enduring work in the upbuilding of the West.**

### San Francisco Engineers' Club

Believing that community singing should not end with the war, the "Engineers' Glee Club" has been started by members of the Engineers' Club of San Francisco, as a nucleus for community singing at the local meetings of engineers. The first instruction rehearsal was held at the Engineers' Club, San Francisco, on Feb. 27th and the institution promises to prove worth while both to the participants and to the audience at the various engineering meetings.

### American Welding Society

The first meeting of the American Welding Society was held on March 28, 1919, at the Engineering Societies Building, New York, and the Constitution and By-Laws were adopted as recommended by the organization committee. The following officers were elected:

President, C. A. Adams, Cambridge, Mass.
Vice-President (one year), J. M. Morehead, New York.
Vice-President (two years), G. L. Brünner, Utica, New York.

# Coronado Convention Plans

M. A. DeLEW, president of the California Association of Electrical Contractors and Dealers; prominent electrical contractor, San Francisco District.

SAMUEL KAHN, president of the Pacific Coast Section, N. E. L. A.; general manager of the Western States Gas & Electric Company.

TRACY E. BIBBINS, president of the Pacific Division, National Electrical Supply Jobbers' Association; president Pacific States Electric Company.

JOHN A. BRITTON, chairman of the Public Policy Committee, Pacific Coast Section, N. E. L. A.; vice-president and general manager of the Pacific Gas and Electric Company.

Due in substantial part to the broad vision and helpful work of these four men, backed by the organized associated activities they represent, the electrical industry in California, Nevada and Arizona, representing an invested capital of over half a billion dollars, has emerged from one of the most trying periods in the world's history, with energies that have expanded and increased under stress to such a degree that never before has the outlook of helpfulness been more brilliant for continued growth and service of the method electrical in the West, where in previous years so many world records in activity of this sort have been established.

## PROGRAM

**Joint Conventions at Hotel del Coronado, April 28-May 3**

PACIFIC COAST SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION

CALIFORNIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS

PACIFIC DIVISION, ELECTRICAL SUPPLY JOBBERS' ASSOCIATION

**Monday, April 28th**

Meeting and Golf Play–Electrical Supply Jobbers Association.

**Tuesday, April 29th**

Meeting and Golf Play–Electrical Supply Jobbers Association.

10:00 a.m.—Meeting of Advisory Committee, California Cooperative Electrical Campaign, L. H. Newbert, Chairman.

7:30- 9:00 p.m.—Contractors' Executive Committee Meeting.

**Wednesday, April 30th**

All Day —Registration and Reception of Arriving Guests.

9:00-12:00 a.m.—Contractors' Joint Meeting of Committee on Supplies.

10:00 a.m.—N. E. L. A. Executive Committee Meeting.

3:00 p.m.—N. E. L. A. Opening Meeting. Ladies invited.
Address of Welcome: William Clayton.
Response.
Prsident's Address: Samuel Kahn.
Secretary's Report: Arthur H. Halloran.
Treasurer's Report: J. F. Pollard.
Report of Committee on Cooperation: H. F. Jackson.
Report of Membership Committee: Henry Bostwick.
Report of Accounting Committee: B. B. Stitch.
Report of Engineering Committee: H. A. Barre.
Report of Commercial Committee: A. W. Childs.
Report of Publicity Committee: Ed. Whaley.
Announcements.

4:00 p.m.—Reception for Ladies.

7:30 p.m.—Meeting of Retail Merchants, G. E. Arbogast, presiding.

8:30 p.m.—Motion Pictures. Informal Dancing.

**Thursday, May 1st**

9:15-12:00 a.m.—Commercial Committee Session Discussions.
"The Proper Training of the Sales Personnel," by Lee H. Newbert, Pacific Gas & Electric Company; J. F. Pollard, Sierra & San Francisco Power Company; I. W. Alexander, San Joaquin Light & Power Corporation.
"How Can the Electrical Industry Assist the Architect in Serving His Clients?" by J. O. Case, General Electric Company.
"Selling the Idea," by H. L. Harper, Western Electric Company.

9:15-12:00 a.m.—Engineering Committee Session Discussions.
Report of Committees on Insulators and on Line Safety Code, J. S. Lisberger.
"Interchange of Power between Southern California Edison Company and San Joaquin Light & Power Corporation," by G. R. Kenny, San Joaquin Light & Power Corporation.
"Relay Protective Systems," by G. E. Armstrong, Southern California Edison Company.
"Automatic Inductor Generator Plants," by E. A. Quinn, San Joaquin Light & Power Corporation.

12:15 p.m.—Convention Picture.

2:00 p.m.—Joint Meeting of Commercial and Engineering Sections. Paper by S. M. Kennedy—"The Man in the Street."

2:45- 5:00 p.m.—Commercial Committee Session Discussions.
Papers "Problems of Electric Cooking and Heating," by B. N. Maddox, Southern California Edison Company.
"The Contractor-Dealer of the Future," by John C. Rendler, Southern California Company.
"Appliance Sales Policy," by T. W. Simpson, Federal Sign System (Electric).

2:45- 5:00 p.m.—Engineering Committee Session Discussions.
Papers "Converting a Steam Plant to Standby Operation," by L. M. Klauber, San Diego Consolidated Gas & Electric Company.
"Kw-Hr. per Barrell of Oil, What Does It Mean?" by S. J. Lisberger, Pacific Gas & Electric Company.
"Powdered Fuel," by C. H. Delany, Pacific Gas & Electric Company.

5:00 p.m.—Swimming Tournament in plunge.

Evening Ball at Hotel del Coronado.

**Friday, May 2nd**

10:00-12:00 a.m.—Meeting of Electrical Contractors and Dealers.

9:00 a.m.—Visit to Army Aviation School.

VERDICT rendered — it was your war

—Victory Loan

**H. A. BARRE**, chairman of the Engineering Committee, Pacific Coast Section N. E. L. A.; electrical and mechanical engineer, Southern California Edison Company.

**H. H. JONES**, chairman of the convention committee, Coronado Conventions; general manager of the San Diego Consolidated Gas and Electric Company.

**A. W. CHILDS**, chairman of the commercial committee of the Pacific Coast Section, N. E. L. A.; assistant general agent, Southern California Edison Company.

To these three men, backed by their respective committees, has fallen the task of arranging the papers and preparing for the convention details at Coronado. How well and how excellently this work has been performed may be gleaned at a glance by running through the pages of this issue of the Journal of Electricity, which is replete with their handiwork.

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**2:00- 4:00 p.m.**—Engineering Committee Session Discussions.
Papers "Extending the Range of Accuracy of Watthour Meters," by O. A. Knopp, Pacific Gas & Electric Company.
"Electric Welding," by John Hood, General Electric Company.

**2:00- 4:00 p.m.**—Commercial Committee Sessions Discussions. (Subjects to be announced later.)

**4:00- 5:00 p.m.**—General Business Session.
Report of Public Policy Committee.
Report of Nominating Committee.
Report of Resolution Committee.
Unfinished Business.
Closing Exercises.

**7:30 p.m.**—Banquet.
Toastmaster—Mr. William Clayton, United Light, Fuel & Power Company, Coronado.
Speaker of the Evening—Col. H. M. Byllesby.
Informal Dancing.

**Saturday, May 3rd**

Unfinished Business.
All of this day to be devoted to sports and entertainment.

**SOME WHO WILL ATTEND**

Alexander, I. W., San Joaquin Light & Power Corporation, Fresno
Alvord, R. M., General Electric Company, San Francisco
Anderson, F. A., U. S. Shipping Board, San Francisco
Anderson, S. B., Pacific States Electric Company, San Francisco
Ballard, R. H., Southern California Edison Company, Los Angeles
Barre, H. A., Southern California Edison Company, Los Angeles
Bennett, T. J., Rex Electric Company, San Francisco
Bergman, L. John, Pass & Seymour, Syracuse, N. Y.
Berry, W. S., Western Electric Company, San Francisco
Bibbins, T. E., Pacific States Electric Company, San Francisco
Boyd, F. E., General Electric Company, San Francisco
Brainerd, W. F., California Electrical Cooperative Campaign, San Francisco
Bullen, D. R., General Electric Company, Schenectady, N. Y.
Bussman, H. T., Bussman Manufacturing Company, St. Louis, Mo.
Case, J. O., General Electric Company, Los Angeles
Chandler, A. E., California Water Commission, San Francisco
Courtright, H. H., Valley Electrical Supply Company, Fresno
Davis, C. C., California Electrical Cooperative Campaign, San Francisco
DeLew, M. A., San Francisco
Deming, W. M., Journal of Electricity, San Francisco
Elliot, Albert, Sec'y Pac. Coast Sect'n, Elec. Supply Jobbers, San Francisco
Eltringham, R. L., California Accident Commission, San Francisco
Fagan, F. D., General Electric Company, San Francisco
Fisher, R. E., Pacific Gas & Electric Company, San Francisco
Goodwin, W. L., General Electric Company, New York
Hall, W. Brewster, Pass & Seymour, Syracuse, N. Y.
Halloran, A. H., Journal of Electricity, San Francisco
Harris, D. E., Pacific States Electric Company, San Francsico
Heise, Carl, Westinghouse Electric & Manufacturing Co., San Francisco
Hillis, C. C., Electric Appliance Company, San Francisco
Hood, J., General Electric Company, San Francisco
Hopkins, H. C., Westinghouse Electric & Manufacturing Co., Los Angeles
Hughes, Geo. A., Edison Electric Appliance Company, Inc., Chicago
Kahn, Samuel, Western States Gas & Electric Company, Stockton
Kennedy, S. M., Southern California Edison Company, Los Angeles
Kirkland, H. B., American Conduit Mfg. Co., New Kensington, Pa.
Lisberger, S. J., Pacific Gas & Electric Company, San Francisco
Maxheimer, F. C., Home Specialty Co., Cleveland, O.
Myrtle, F. S., Pacific Gas & Electric Company, San Francisco
Osborne, G. C., Edison Lamp Works, Cleveland, O.
Page, A. D., Edison Lamp Works, Cleveland, O.
Pollard, Jas. F., Sierra & San Francisco Power Company, San Francisco
Redpath, J. W., Sec'y Cal. Ass'n Contractors & Dealers, San Francisco
Reid, H. C., Pacific Fire Extinguisher Co., San Francisco
Rockafellow, E. W., Western Electric Company, New York
Sawyer, L. P., National Electric Lamp Works, Cleveland, O.
Shreve, E. O., General Electric Company, San Francisco
Sibley, Robert, Journal of Electricity, San Francisco
Somers, Frank, Century Electric Company, San Jose
Spring, A. L., Cal. Electrical Cooperative Campaign, Los Angeles
Simpson, T. W., Federal Sign System (Electric), San Francisco
Whitestone, S. L., General Electric Company, Schenectady, N. Y.
Wishon, A. E., San Joaquin Light & Power Corporation, Fresno

### Pacific Coast Gas Association

The first "Get-together Dinner" of the Association for the season 1919 was held at the Hotel Alexandria, Los Angeles, California, on Saturday, March 15, 1919, there being 135 members present, President Kuster presiding. During the serving of the dinner entertainment was provided and letters and telegrams read from those unable to be present.

One of the most interesting features was the reading of questions received in response to request, and the answers to same, and it is the intention to make this a feature of the second get-together dinner which will be held in San Francisco during the month of July.

### Electrical Credit Association of the Pacific Coast

The fourteenth annual dinner and meeting of the Electrical Credit Association of the Pacific Coast was held at Tait's Cafe, San Francisco, April 3rd, with an attendance of forty-three members and guests. S. B. Anderson, president, acted as toastmaster. Addresses were made by Captain A. E. Graupner on "Observations at the Front," by C. C. Hillis on "The National Electrical Credit Association," by A. M. Irwin on "The Business Outlook," by C. E. Wiggin on "The Relation between the Credit and the Sales Departments," by F. P. Vose and A. H. Elliot.

Officers for the ensuing year were elected as follows:

| | |
|---|---|
| President—H. J. Zweifel | Executive Committee— |
| 1st Vice-President—R. Holtermann | F. A. Morton |
| 2nd Vice-President—J. J. O'Reilly | C. W. Goodwin, Jr. |
| 3rd Vice-President—H. C. Chapman | H. I. England |

Reports showed the association to be in a flourishing condition and most successful in the conduct of its business.

The following were present:

Thomas Day Company—James T. Gates.
Dunham, Carrigan & Hayden Company—C. E. Wiggin, F. A. Morton.
Electric Appliance Company—C. C. Hillis, A. B. Cram, A. Meinema, H. Jensen, H. J. Zweifel.
Electric Ry. & Mfrs. Supply Company—J. H. McClellan, Geo. Curtis.
Garnett Young Company—E. C. Kinsey.
General Electric Company—J. V. Anthony.
Gilson Electrical Supply Company—C. Gilson, H. I. England.
Holabird Electric Company—R. Holtermann, E. J. Duggan.
Illinois Electric Company—S. M. Murray.
National Carbon Company—F. G. Beck, F. P. Gillespie, C. P. Matthey.
N. Y. Insulated Wire Company—L. E. Sperry.
Pacific States Electric Company—S. B. Anderson, C. W. Goodwin, Jr., H. R. Olson, Roy Worth, H. C. Chapman, Leon Van Atta.
Roberts Manufacturing Company—H. J. Bayliss.
Standard Underground Cable Company—D. S. Smith.
U. S. Steel Products Company—Harry Rogers.
Western Electric Company—E. J. Wallis, John Bray, L. J. Brown.
Westinghouse Electric & Manufacturing Company—A. M. Irwin, C. E. Thompson.
Westinghouse Lamp Company—W. C. Wurfel, Geo. Whitehead.
Capt. A. E. Graupner, F. P. Vose, A. H. Elliot, W. P. Smith, W. M. Deming, A. H. Halloran.

**The Serious Task of Passing on Credits is Lightened Once a Year at the Annual Dinner of the Electrical Credit Men of the Pacific Coast—this being a picture of the 14th annual affair where members expressed their credo in human nature.**

## WESTERN MEETINGS

**San Francisco Electrical Development League —**

April 7—Mr. Harrison of Wells Fargo Express Co.—"Packing for Shipment by Express."

**Portland Sections, N. E. L. A. and A. I. E. E. —**

April 7—J. W. Sadler, Great Northern Concrete Shipbuilding Company—"Concrete Ships."

**Engineers' Club, San Francisco —**

April 3—Dr. W. F. Durand—"Personal Experiences in France."

**A. I. E. E., Denver Section —**

April 9—Lieut.-Col. H. S. Crocker—"Construction of Army Supply Base at Brooklyn, N. Y."

**Jovian League, Los Angeles —**

April 2—Capt. C. A. Gorelangton—"Some Things the Engineers Accomplished in France"; A. G. Morphy—"Over the Top in Oklahoma."

**A. I. E. E., Seattle Section —**

April 15—L. F. Curtis, University of Washington—"Analysis of Wave Form by Means of Indicating Instruments."

## LAYING A SUBMARINE TELEGRAPH CABLE

At the Feb. 4th meeting of the Portland Sections, N. E. L. A. and A. I. E. E., as reported in the last issue of the Journal of Electricity, the subject of laying some 18,000 feet of submarine cable across an arm of Puget Sound was discussed by H. J. Shephard from the Seattle office of the Pacific Telephone & Telegraph Company. A brief summary of the talk is here given. The cable described in the paper forms approximately .6 of the total submarine distance.

The cable consisted of 24 pairs of double paper insulated copper wire, specially twisted and arranged to eliminate cross talk conditions and maintain an electrical balance between the pairs. The lead sheath about this cable was one-quarter inch in thickness. The mechanical protection was secured by spiral windings of steel surrounded by a heavy protection of jute. The outside diameter of the cable including the jute wrapping was two and three-eighths inches. The maximum depth encountered in the channel was 800 feet and the pressure upon the cable was estimated to be 377 pounds per square inch. This represents so far as known the greatest depth in which paper insulated telephone cable has been successfully laid.

The care with which splices were made in this cable in order to maintain the electrical balance, the installation, and at the same time secure a moisture proof sheath, as well as to replace the spiral windings in such a manner as to take the strain of the cable on the steel wire instead of allowing it to come upon the spliced lead sheath, while at the same time keeping the joints reasonably flexible, was shown in a very interesting manner by means of lantern slides. The method of handling this great length of 2⅜ in. cable was very clearly shown also by means of lantern slides accompanying the speaker's description of the affair.

The channel across which the cable was to be laid had been carefully surveyed and platted on section paper. Also, buoys were carefully located so that the direct line could be followed and at frequent intervals it was possible to determine the exact location of the barge which was playing out the cable.

Of particular interest was the apparatus devised for supporting the cable as it left the barge and dipped into the water. The cable was supported in this device on pulleys grooved to fit the cable and so placed in the quadrant frame as to maintain the curvature of the cable as it left the reel and thereby avoid subjecting the cable to any additional and unnecessary strains.

The cable was wound upon a huge reel mounted on the barge, a donkey engine being used to fill the reel with the cable. Two tugs were used to handle the barge, one being lashed to the side of, and the other preceding the barge and towing it by means of a cable.

The playing out of the cable was governed by means of three friction brakes attached to the reel and hand-controlled. In addition a 100 horsepower generator was also geared to the reel after the donkey engine had been disconnected. The field of the generator was supplied by means of a rheostat. The load of the generator was carried through a set of heavy grids so connected that a variable load could be placed upon the machine. By means of the proper indicating instruments it was possible to control the load at will and to insure that the cable would be played out at a uniform rate and in accordance with the requirements as shown by the survey chart. This electric brake provided a most satisfactory method of controlling the reel and the friction brakes virtually amounted to emergency brakes.

**V INDICATE your claim to patriotism**

**—Victory Loan**

The cable was run out over a wooden wheel rotating it by means of friction contact. The wheel was provided with a brush and contact point in series with a counter in an electrical circuit so that it was possible at any time to determine exactly the number of revolutions of the wheel and therefore the number of feet of cable which had been sent overboard. By means of this counter, the anchored buoys, and of the charted section of the channel, it was possible at any time to check the amount of cable laid with the amount which the record showed should be out at that point, and to be sure that the brake was being handled in a proper manner. These checks made at various points along the route indicated a very close relation existing between the actual and estimated lengths of cable, and at the end of the laying of the cable the two values checked within a relatively few feet of each other.

This certainly exemplified very clearly the exceptional engineering skill used in the matter of this submarine cable installation. It should also be mentioned that telephonic communication was maintained through the cable at all times.

# "Kilowatt Hours per Barrel of Oil" Diagrams

BY S. J. LISBERGER

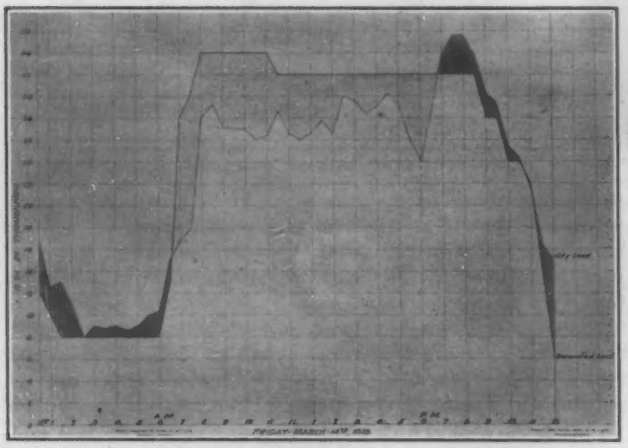

Figure 1

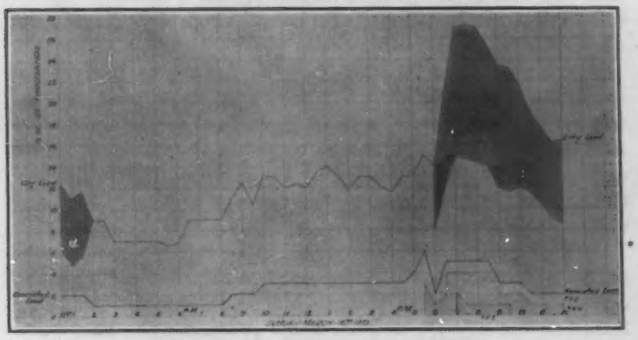

Figure 2

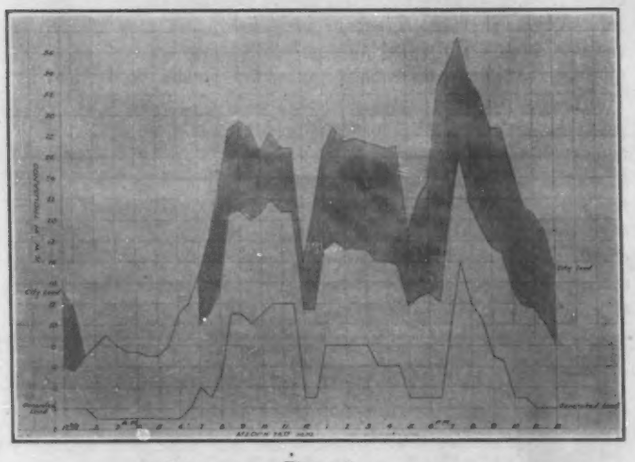

Figure 3

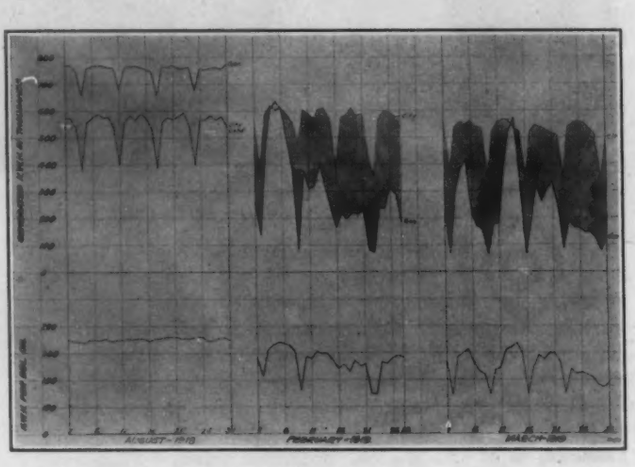

Figure 4

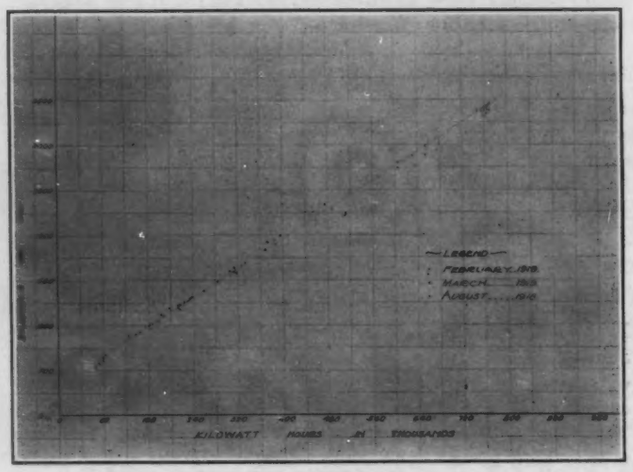


Figure 5

The above charts illustrate the article on "Kilowatt Hours per Barrel of Oil" by S. J. Lisberger, appearing on page 363 of this issue. Figures 1, 2 and 3 are daily charts for March 14, 16 and 28, showing the fluctuations through the day. Figure 4 shows the monthly curve of a station delivering the three different types of service brought out in Mr. Lisberger's article. The lower curves show the irregularities in the kw-hr. generated per barrel of oil even in this short period and the unsatisfactory basis for comparison which the term furnishes. Figure 5 is a sample of the alternative method of charting suggested which admits of greater accuracy in comparison.

## NATION'S ELECTRICAL WHOLESALERS TO DISCUSS BUSINESS FUTURE AT DEL MONTE

BY M. EMMILINNE PITT

The Westinghouse Agent-Jobbers Association are making elaborate plans for their annual convention at Del Monte, California, May 4 to 11. Among those who will address the convention are John J. Jackson, general attorney for the Westinghouse Electric & Manufacturing Company and the Agent-Jobbers' Association, who will speak on "Motives in Merchandising. Samuel Adams Chase, special representative of the Westinghouse Electric and Manufacturing Company, a man who has by extended travel the world over, by visiting the business places of jobbers from coast to coast and by an intensive and exhaustive study of electrical merchandising become an authority, will also speak. William L. Goodwin, the originator of the "Goodwin Plan," will explain its meaning and significance.

SAMUEL ADAMS CHASE, a man of broad vision in the merchandising of electrical ware, who will lead in the discussion of the Westinghouse Agent-Jobbers' Convention at Del Monte, May 4-11, 1919.

Officers of the association are: President, J. S. Schmidtbauer, vice-president of the Julius Andrae & Sons Company, Milwaukee, Wisconsin; vice-president, S. L. Nicholson, assistant to vice-president of the Westinghouse Electric & Manufacturing Company, Pittsburgh; secretary, Arthur J. Cole, vice-president of the McGraw Company, Omaha, Nebraska; treasurer, J. E. McClernon, president of the Northwestern Electric Equipment Company, New York; assistant secretary, H. T. Pritchard, Westinghouse Electric & Manufacturing Company.

The program for the convention has not yet been definitely announced, but it is assured that some of the most prominent men of the East are to participate as well as electrical jobbers on the Pacific Coast. J. C. Schmidtbauer, vice-president and manager of the Julius Andrae & Sons Company of Milwaukee, who is recognized for his stand on "Justice and Service to the Customer," will preside at the convention. J. C. McQuiston, manager of the department of the Westinghouse Electric & Manufacturing Company, perhaps the leading exponent in the electrical world of "Institutional Publicity as a National Advertising Policy," will direct the entertainment of those attending. Other prominent men who will be at Del Monte are: S. L. Nicholson, assistant to vice-president of the Westinghouse Electric & Manufacturing Company; J. E. McClernon, president of the Northwestern Electric Equipment Company of New York City; H. T. Pritchard, of the supply department of the Westinghouse Electric & Manufacturing Company; T. Julian McGill, of Chicago; H. R. Carroll, of the Carroll Electric Company, Washington, and many others.

J. C. McQUISTON, an advertising man of national reputation who will outline a more effective campaign for national advertising.

Some of the members of the association from the Coast who will take an active part at Del Monte are:

K. E. Van Kuran, Los Angeles
C. B. Hall, Los Angeles
C. E. Heise, San Francisco
Carl L. Wernicke, Portland
C. M. Will, Portland
P. J. Aaron, Seattle
W. R. Dunbar, San Francisco
R. A. Balzari, San Francisco
F. N. Averill, Portland
W. D. McDonald, Seattle
S. H. Taylor, San Francisco
H. D. Howell, Seattle
H. C. Hopkins, San Francisco
D. C. Pence, Los Angeles
C. V. Aspinwall, Seattle
J. H. Jamison, Los Angeles

The Westinghouse Agent-Jobbers' Association have chartered a special train for the trip which will leave Chicago Sunday, April 27, arriving at Del Monte May 4. They expect to spend a day at the Grand Canyon and one day in Los Angeles.

Samuel Adams Chase, special representative of the Westinghouse Electric and Manufacturing Company, is general chairman of the convention arrangements, but the details of hotel arrangements, program and entertainment at San Francisco and Del Monte are in charge of Carl E. Heise and Samuel H. Taylor of San Francisco, and for Los Angeles K. E. Van Kuran and C. B. Hull of that city, and other committees will be appointed to take good care of the delegates and guests at Portland, Seattle, Salt Lake City and other points en route.

W. L. GOODWIN, the noted founder of the "Goodwin Plan," who will tell again to his old-time friends in the West, his message of cooperative helpfulness.

### WESTINGHOUSE AGENT-JOBBERS

H. J. Gundlach, Manager Electrical Dept., Mine & Smelter Supply Co., Denver, Colorado.
J. C. Schmidtbauer, President, Westinghouse Agent-Jobbers' Association and Vice-President Julius Andrae & Sons Co., Milwaukee, Wis.
J. E. McClernon, President Northwestern Electric Equipment Company, New York, N. Y.
F. W. Woolrich, President Commercial Electric Supply Company, Detroit, Michigan.
Walter S. Blue, Montana Electric Company, Butte, Mont.
W. S. P. Mayo, Tower-Binford Co., Richmond, Va.
Samuel H. Taylor, President Electric Railways & Supply Co., San Francisco, and Toastmaster Westinghouse Banquet.
Max McGraw, President the McGraw Co., Omaha, Neb.
F. N. Averill, President Fobes Supply Co., Portland, Oregon.
F. Riebel, Jr., Gen. Mgr. Commercial Electric Supply Co., Detroit, Mich.
N. G. Harvey, Vice-President Illinois Electric Co., Chicago, Ill.
G. H. Miller, Manager Tel. Electric Co., Houston, Tex.
C. B. Hawley, Gen. Mgr. Inter-Mountain Electric Co., Salt Lake City, Utah.
C. B. Hall, Sec'y-Treasurer Illinois Electric Co., Los Angeles, Cal.
G. H. Smith, Penn Electric Engineering Co., Scranton, Pa.
G. M. Stuart, President Stuart-Howland Co.
H. R. Carroll, Carroll Electric Company, Washington, D. C.
L. D. Carroll, Carroll Electric Company, Washington, D. C.
W. B. Satterlee, Satterlee Electric Co., Kansas City, Mo.
F. D. Phillips, President Central Telephone & Electric Co., St. Louis, Mo.

### WESTINGHOUSE REPRESENTATIVES

S. L. Nicholson, Assistant to Vice-President, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.
W. D. McDonald, District Mgr. Westinghouse Electric & Manufacturing Company, Seattle, Wash.
K. E. Van Kuran, Manager Westinghouse Electric & Manufacturing Company, Los Angeles, Cal.
T. Julian McGill, District Manager Westinghouse Electric & Manufacturing Company, Chicago, Ill.
Walter Cary, Vice-President, Westinghouse Electric & Manufacturing Company, New York.
Merrill C. Morrow, Assistant to Manager, Supply Department, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.
J. M. Curtin, Industrial Department, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.
J. C. McQuiston, Manager Department of Publicity, Westinghouse Electric & Manufacturing Company, and Chairman of Transportation, Westinghouse Agent-Jobbers' Convention, Del Monte, California.
Carl M. Heintz, Westinghouse Electric & Manufacturing Company, Los Angeles.
John J. Jackson, General Attorney, Westinghouse Electric & Manufacturing Company and Agent-Jobbers' Association.
J. J. Gibson, Manager Supply Dept., Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.
L. M. Cargo, Denver Office Westinghouse Electric & Manufacturing Co.
W. W. Briggs, District Manager Westinghouse Lamp Company, New York.
C. E. Heise, Manager San Francisco Office, Westinghouse Electric & Manufacturing Company.
W. C. Wurfel, Westinghouse Lamp Company, San Francisco, Cal.

VENERATE the victors—but support them, too

—Victory Loan

OFFICERS OF THE WESTINGHOUSE AGENT-JOBBERS' ASSOCIATION

# Books and Bulletins

### Repairing the German Ships

The romantic story of how the German ships which their mutilators expected would take years to repair were put in shape within five and a half months time by the use of electric welding is told in an interesting booklet published by the Wilson Welder & Metals Company, Inc., of New York.

### Catalog of Electric Supplies

A most complete catalog of their line of electrical supplies has been published by the Electric Railway & Manufacturers' Supply Company, jobbers and manufacturers of electrical merchandise, of San Francisco. The book is attractively gotten up with buckram binding in corn color and consists of over 1200 pages of illustrated matter. It is a complete and up-to-date reference book of standard electrical supplies with price listings for the convenience of customers although, of course, these are subject to change without notice. The following letter received by the company is indicative of the high excellence of the catalog as a business document:

Electric Railway & Manufacturers' Supply Co:

I think you will be interested to know that we have selected your new catalog as one of two leading catalogs of electrical supplies at the request of the Graduate School of Business Administration of Harvard University, to be included in their library—and are sending them a copy of your catalog accordingly today.

Yours truly,

R. R. DONNELLEY & SONS CO.

### Powdered Fuel Systems

The West is specially interested in powdered fuel and in consequence in a bulletin recently issued by the Quigley Furnace Specialties Company, Inc., which describes the details of equipment and applications of the Quigley Powdered Fuel System for preparing, distributing and burning powdered fuel. Photographs from actual installations well illustrate the steps in the process.

# LATEST IN EVERYTHING ELECTRICAL

**(One of the most interesting developments of the war from an electrical standpoint is the advance which was made in practical telephony. The story of the anti-noise transmitter which played such an important part in this development is here told by Capt. Clark, who as Captain of Engineers and later as Railway Regulating and Liaison Officer with the 30th Artillery Brigade saw service at Verdun through both the St. Mihiel and Argonne drives.—The Editor.)**

## THE MAGNAVOX ANTI-NOISE TELEPHONE

BY CAPTAIN ADDISON N. CLARK

That great wars breed great inventions is a truism much in evidence in these times. That such a war as the late conflict in Europe likewise stimulates development in existing apparatus and machinery, and creates undreamed uses for them—uses that often are practical after peace has come—is one of the few factors that in any measure compensate for the horrors.

For various reasons, into which it is unnecessary to go here, few radical developments had taken place in the field of telephony during the last quarter century. Suddenly the needs of war called into being methods of intercommunication hitherto undeveloped; and now we have the spectacle, for example, of the Secretary of the Navy conversing by wireless with the President of the United States, from the American mainland to a ship in mid-Atlantic. The use of the wireless telephone as a means of communication between the ships of a fleet is no longer a novelty. Nor is it a novelty to read of wireless telephone communication between the pilots of aeroplanes in flight—though it is only yesterday, industrially speaking, that the phenomenon of flight itself, in a heavier-than-air machine, was a front-page story in the daily press and excited the public mind as did the advent of the steam engine or the first transatlantic cable.

The "Magnavox," original invention of Messrs. Jensen and Pridham, which, as shown here, projected to a distance of seven miles in Napa Valley the music of the phonograph connected with it. It was one of these that later permitted Mayor Rolph of San Francisco to speak directly and without effort to a throng of over 75,000 people in the open air.

Because of the natural need for rigid secrecy in all matters dealing with war material, prior to the signing of the armistice, it has not been known save in a limited circle that it was a Pacific Coast manufacturing concern that won a most enviable record in the production of wireless telephone transmission for inter-aeroplane communication. Nor has it been known that, coincidentally with that achievement, the same California organization was awarded important contracts by the Bureau of Steam Engineering, United States Navy, for installing its "Anti-Noise" wireless telephone equipment on sea-planes for coast patrol and counter-submarine work, both in American and European waters. Both the French and British governments were also heavy purchasers and users of Magnavox equipment for sea-plane wireless telephony during the war.

Entirely on the merits and efficiency of performance of its new balanced-diaphragm Anti-Noise telephone transmitter, the Magnavox Company of San Francisco, a corporation young in the telephone field but now a powerful factor in the future of telephony through the recent developments of its engineers, stepped into a prominent place in the supplying of transmitters to the United States government for the exacting work of aeroplane intercommunication during flight.

That this Pacific Coast organization, barely known before America entered the great war—and then only through its development to a commercial basis of its electro-dynamic loud-speaking telephone receiver known as the "Magnavox"—has leaped into the field as such a powerful factor in the telephone world, is one of the most striking of the innumerable romantic industrial developments of the war. And that the Magnavox Company, now that the war is over and the world of commerce must absorb its products, is aggressively going ahead and building a modern factory to supply the daily increasing demand for telephone apparatus that is absolutely immune from the effects of extraneous noise and disturbance, is one of the outstanding features in California's industrial development today.

The Magnavox Anti-Noise Transmitter as supplied to the United States Signal Corps for wireless telephony between aeroplanes and from 'planes to the ground; also between pilot and observer. Observe, in this set, the striking openness of the transmitter diaphragm on all sides.

Like so many inventions that have revolutionized industry, the Anti-Noise transmitter developed by Peter L. Jensen and Edwin S. Pridham, engineers of the Magnavox Company and pioneers in the adaptation to commercial use of the electro-dynamic principle of telephone reception, is extremely simple.

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**VENT that patriotism you talked about**

**—Victory Loan**

When one who has a lively memory of the exasperation incident to trying to carry on a telephone conversation against outside noises of any sort—from the racket of riveting hammers on the steel building next door to the wailing of an infant in the next room—tries to visualize some scheme for eliminating from the line all sound save that of his own and the other person's voice, there arise visions of complicated retardation coils and sound-proof face masks and the like; not to mention involved and mysterious wiring. And with these preconceptions in mind, the first glimpse of the

E. S. Pridham, co-inventor of the Magnavox and the Anti-Noise Transmitter, demonstrating the new Model B-2 equipment, a peace-time development of the aeroplane anti-noise telephone. With this desk stand equipment, it is possible to telephone without annoyance from noise, in a boiler shop or alongside the open exhaust of a gas engine. A sound-proof booth is unnecessary.

Magnavox Company's device that has made undisturbed telephone communication possible under the most harrowing conditions of outside noises and disturbances, is apt to produce a distinct mental jolt. For, with the exception of the light aluminum protecting case and, in the case of the apparatus for inter-aeroplane communication and similar uses, the small brackets that hold the instrument at the proper distance from the operator's mouth, the whole device would almost go into the case of an Ingersoll watch.

The development of the Anti-Noise transmitter as it exists today, and the success that has attended every Army and Navy trial of the instrument and every practical demonstration of it, are due to the daring of Jensen and Pridham, its inventors. For, instead of going at the problem from the only too natural angle of attempting to **exclude outside noise from the diaphragm**, they boldly stripped from the essential mechanism of the carbon granule transmitter—the diaphragm and the "button"—every encasement whatever likely to exclude a bit of the extraneous racket. In other words, they threw open the doors and let **all the noise in.** However they opened both the front and back doors, as it were. That is, they allowed the mixture of sound waves equally free access to both sides of the diaphragm. The result was a transmitter that is immune from all influence save that to which it is desired it shall be susceptible—the voice of the person using it—even though the exhaust of two Liberty motors is thundering three or four feet away, or a hundred men are riveting the steel shell of a steamship entirely surrounding the instrument.

To illustrate the simple principle involved, imagine a huge flat gong of the Chinese tom-tom type, suspended by one edge. Then imagine the gong being struck on both sides simultaneously by hammers of equal weight, the blows being equal in force. The gong will not vibrate. Then imagine either a small supplementary hammer striking one side of the gong along with one of the two hammers—or, what amounts to the same thing, a slight increment in the weight of one of the hammers or in the force of its blow. The gong will then vibrate, in direct measure to the additional impulses on one side.

The effect of the twin hammers on the gong is analogous to the effect of extraneous sound waves, due to any nearby noices, on the transmitter diaphragm (since the sound waves are freely admitted to both sides of the diaphragm). In practice, as in theory, they set up no vibrations. Therefore they cause no "side-tone," as transmitter disturbance is designated in telephone parlance. The diaphragm is left free to vibrate solely to the directed voice waves, from the lips of the operator, impinging against one side only.

It is this amazingly simple device, then, that has in a way revolutionized the last quarter-century's painstaking work in transmitter development, and by sheer infallibility of its results under the most grilling Signal Corps tests compelled its acceptance and installation in Liberty aeroplanes as a means of communication from 'plane to 'plane, from 'plane to ground, and from pilot to observer in the same 'plane.

Then came the signing of the armistice with the central powers, and the inevitable cessation in the manufacture of thousands of war-born devices. Many such products were instruments of warfare alone, and the factories making them had to turn to something entirely different to keep their wheels turning and their operatives busy. Some, however, possessed such apparent peace-time commercial value—born though they were of war and its needs—that, after the brief "breathing spell" following the signing of the armistice, and a short period of survey of commercial outlook and possibilities, their makers saw open before them a field even more vast than war necessities had provided.

The Magnavox Anti-Noise telephone transmitter is so evidently of this latter class that already less than six months after the end of hostilities, the demand for apparatus equipped with it is taxing the factory of the company at San Francisco, and work is well under way towards the construction of a thoroughly modern plant in East Oakland. It is expected that the new factory will be completed and in operation by midsummer, ready to turn out Anti-Noise telephone equipment for factory and office use fast enough to meet for a time at least the rapidly increasing demand for telephones that can be used without hindrance or exasperation whatever noise exists.

The engine room and boiler room of a steamship are typical examples of places where the use of an ordinary telephone transmitter would be entirely out of the question. The fact that just now the Magnavox Company is working overtime filling orders from the United States Shipping Board, for complete equipment to install on new ships, gives some conception of the possibilities of the Magnavox equipment The instruments so furnished are for communication between the bridge of the vessel and the compartment aft in which is located the mechanical steering gear — just over the rear of the propeller shaft, and one of the noisiest places on a vessel. In case of mishap to the steering apparatus on the bridge, communication is immediately established from the bridge to the steering engine compartment, by means of the Magnavox standard Anti-Noise marine telephone equipped with the leather helmet of the type used in war-plane work; and the officer on the bridge then directs the engine operator who, with the equipment on his head, is free to devote his entire attention to the control of the steering engine.

The places where such an equipment as the newly-developed Magnavox Type B-2 desk set will find application are almost without number. Boiler works, garages, machine

shops, piano stores, newspaper offices, offices where typewriters are constantly hammering, offices adjacent to steel buildings under construction—these are but a minor list of places where the Anti-Noise transmitter already has been proven a preventive of telephone noise troubles.

The freedom from inductive disturbances of the set that combines the Anti-Noise transmitter with the Magnavox saturated-field electro-dynamic receiver has brought it to the attention of power line engineers as a relief from the

This is all there is to the Magnavox Anti-Noise Transmitter as applied to war aeroplane sets during the war. Take away the brackets and the aluminum case and the whole thing would go into the case of a watch.

harassing conditions that attend the carrying of telephone lines on the same poles or towers with alternating current power lines, and in all alternating current electric light and power stations. This field alone promises wide development in the use of Magnavox apparatus.

Persons partly deaf, or even only moderately hard of hearing, have found in the Magnavox Anti-Noise equipment a relief from virtually all of their troubles in the use of the telephone. The ear that is slightly deaf has its great trouble in the separation of the essential sounds of the conversation from the side-tones or extraneous sounds, when the ordinary solid-back telephone transmitter and common form of electro-magnetic receiver are used. Such people who have tried the combination of the Anti-Noise transmitter and Magnavox electro-dynamic receiver declare that it is indispensable to their free use of the telephone.

While it is impossible, within the limits of this article, to discuss at length the historical development of the "Magnavox," or intensive, loud-speaking telephone transmitter and projector, it will be of interest to add that it was the outgrowth of the formation of a friendship, nine years ago, between two young inventors, neither of whom then could speak the other's language.

Edwin S. Pridham, Californian and Stanford graduate electrical engineer, and Peter L. Jensen, formerly associated with one of Denmark's most famous inventors, Dr. Valdemar Poulson were thrown together on the engineering staff of the Federal Telegraph Company of San Francisco. Dr. Poulsen, one of the outstanding figures in wireless telegraph development, had sent young Jensen to San Francisco to assist in introducing the Poulsen arc system of wireless telegraphy. It was Jensen and Pridham who erected and put into operation the first station in the United States employing this now widely-used and successful system, of which it is sufficient to say that it is now acknowledged to be the most efficient and practical for long-distance radio-communication, and that it was the system employed by the United States Government for keeping General Pershing's headquarters in France in direct touch with the War Department at Washington.

Late in 1910 and early in 1911 Pridham and Jensen visited Europe together, and conferred with many European wireless telegraph pioneers and experts. On their return in 1911 they interested Richard O'Connor of San Francisco, a retired capitalist, in equipping for them an experimental laboratory for the development of ideas gained abroad. It was in this laboratory, at Napa, while working out the problem of a possible improvement of the telephone receiver—usually considered as one of the most sensitive and simple of all electrical instruments—that they struck out in a new direction in telephony and developed the saturated-field electro-dynamic type of receiver, with a moving coil vibrating across traversing lines of magnetic force. This instrument shortly thereafter was developed into the loudest-speaking instrument of telephone history, given the singularly appropriate name of "Magnavox" (from the Latin, "great voice") and soon brought to a basis of commercial utility.

It was one of these instruments that, concealed behind a pillar of the new San Francisco city hall, enabled Mayor Rolph to speak to a vast out-door audience of over 75,000 people in the Civic Center, on Christmas Eve, 1915, and be heard by every one in the throng, as well as by persons in the windows of apartment houses seven blocks away. Sailors on the old battleship "Oregon," anchored off the city in San Francisco Bay, danced on the decks to the music of a phonograph on the Tower of Jewels at the Exposition, projected across the water by the Magnavox. Residents of the city of Napa, during the earliest experimental stages of the instrument, used to ring up the laboratory and request their favorite opera selections.

That such an instrument should have vital commercial value and manifold uses was apparent from the outset; and, with an intervening stage wherein the Commercial Wireless and Development Company (the original corporation formed by Jensen, Pridham and O'Connor) was re-named The Magnavox Company, the latter corporation, retaining its name, was merged with the Sonora Phonograph Company in the wake of the successes of that organization before the Awards Committee of the Panama-Pacific Exposition. It was this merged organization that, continuing the experimental and research work of Pridham and Jensen which had produced such striking developments, gave to the world what in all conservatism has been called, by engineers and scientific men, and by Army and Navy experts of the United States and foreign governments, "one of the most significant developments in telephony during the last quarter of a century"—the Magnavox Anti-Noise transmitter.

## TRADE NOTES

**L. John Bergman,** credit manager of Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., is calling on the trade in the Coast States. Mr. Bergman has long been associated with the firm of Pass & Seymour and has made an intimate study of the relationship between the buyer and seller. His trip to this section of the United States will, no doubt, be richly productive in data and optimism. Mr. Bergman is planning with W. Brewster Hall to attend the Coronado Conventions the last of April.

**Sales Conference —**

On March 20, 1919, sales agents from Los Angeles, San Francisco, Seattle and other Pacific Coast centers in the employ of John A. Roebling's Sons Company met in San Francisco in conference.

VENTURE a little on the war — it's won

—Victory Loan

# NEW ELECTRICAL DEVELOPMENTS

**(The consummation of the electric railway deal in Seattle, the starting of actual work on the power developments planned in the Pacific Central region and in the Southwest, and numerous plans for electric light plants in the towns and cities of the Inter-mountain District are the features of the past two weeks' activities in matters electrical.—The Editor.)**

## THE PACIFIC NORTHWEST

VANCOUVER, B. C.—The Jenkins Electric Company has been incorporated for $10,000.

SEATTLE, WASH.—The Puget Sound Traction Light & Power Company, 7th and Olive streets, will alter the waiting room at 601 Olive street at a cost of $5,000.

SEATTLE, WASH.—A bill has been introduced in the city council authorizing the city lighting department to complete the renewals and repairs to Pipe Line No. 1 and appropriating $10,000 therefor.

WENATCHEE, WASH.—W. L. Chrysler of Wilbur, Wash., has bought out the Root Electric Company at Wenatchee, Wash., formerly owned by Jose & Downey, and will conduct the business in future.

SPOKANE, WASH.—All the property rights and franchises of the Spokane Heat, Light & Power Company once valued at $2,000,000, will be sold under the hammer at the door of the plant on April 21 at 10 o'clock a.m.

SEATTLE, WASH.—Bids will be received by the county commissioners up to May 5, 1919, at 10 a.m., for an electric exhaust blower in the basement of the county-city building. Plans may be examined at the office of the county commissioners.

YAKIMA, WASH.—N. C. Richards, president of the Yakima Valley Transportation Company, Yakima, Wash., has filed with the public service commission an amended schedule of street car fares for the city passenger lines, providing for a 10-cent fare, with the possibility of buying tickets for 8 cents and a school children's rate of 4 cents.

SEATTLE, WASH.—A warehouse 220 x 56 feet will be constructed by Stone & Webster Corporation, Stuart building, at a cost of $15,000, for storing the machinery and equipment owned by the Puget Sound Traction Light & Power Company not taken over when the city purchased the street car systems. The roof of the building will be supported by heavy-timbered trusses.

SEATTLE, WASH.—In order to complete the municipal elevated railway the city council has taken steps to offer the remaining $150,000 of a $500,000 bond issue authorized for the project, a resolution has been introduced directing the city comptroller to offer such securities and a bill was introduced in council providing for the completion of extensions and betterments to the existing municipal street railway and appropriating $148,201.96 therefor.

SEATTLE, WASH.—A factory for the making of marine electrical equipment is to be located here in the near future by the Horne Manufacturing Company of Brooklyn, according to an announcement by the industrial bureau of the Seattle Chamber of Commerce and Commercial Club. The company has established its western offices at 222 Grand Trunk Pacific Dock, Seattle. M. E. Weeks and A. A. Harris, members of the company, are on the ground. Incorporation articles in the state were applied for under the name of the Horne Manufacturing Company of Washington.

SEATTLE, WASH.—The city is to add extensively to its light and power system in the near future. New lines will be constructed for the purpose of street lighting and furnishing light and power to business and residence districts. A large part of the funds will be used to prepare for the additional current coming from the Cedar River plant and the Skagit plant. The substation at Ballard will be equipped; also the industrial substation on Spokane street and tie-lines will be constructed covering substations. The plan to be ultimately carried through is to bring the Cedar River current to the Spokane street substation on Spokane street instead of the substation at 7th avenue and Yesler Way, which will become a distinct station with a lower voltage for the main business section. Proceeds from the sale of $750,000 utility bonds will be available within a few days for this purpose.

## THE PACIFIC CENTRAL DISTRICT

MOUNTAIN VIEW, CAL.—The board of trustees have expressed their approval of a municipal park, lighting and gas plant.

COALINGA, CAL.—The city has been offered the plant of the Coalinga Gas and Power Company for $40,000. The matter is in the hands of the city engineer to appraise the property.

SACRAMENTO, CAL.—Application has been made by the Sacramento Northern Railroad before the State Railroad Commission to make permanent its order issued in 1913 temporarily suspending the railroad's branch between Chico and Hamilton.

BAKERSFIELD, CAL.—Steps were taken at a meeting of power-users' representatives of Kern, Tulare, Kings and Stanislaus counties, held at Tulare City, to organize the San Joaquin Valley Public Utilities Association. Jay A. Hinman was appointed chairman for Kern county.

BAKERSFIELD, CAL.—A meeting was held April 12 at Mojave to take steps to irrigate 250,000 acres of land around Mojave, Inyokern, Fremont and Castle Rock by impounding waters of Owens River, Red Rock, Pine Tree and Jawbone canyons. Reservoirs will be built.

PLACERVILLE, CAL.—It is understood the Western States Electric Company contemplates starting work soon on its 30,000 horsepower hydroelectric plant. This will be constructed in three 10,000 horsepower units, the first to be started as soon as weather conditions permit.

BAKERSFIELD, CAL.—The Southern California Edison Power Company is rapidly completing its plans for an early start on its new $20,000,000 power plant on the upper Kern river. More than 2000 workmen will be employed on the project, which will require two or three years in building.

OAKLAND, CAL.—The application of the Great Western Power Company for a new trial of the case in which the city of Oakland was awarded an $80,000 judgment has been denied. A technical error in the records, amounting to $12, which was one of the arguments for the new trial, will be settled by an agreement.

NEWCASTLE, CAL.—In connection with the movement for the establishment of great irrigation projects by the state, it is interesting to note that the state engineers have been making inspections in Placer county of prospective reservoir sites and water supplies. It is stated that the Bear River project of Dr. J. L. Rollins and associates has been inspected by the engineers.

OROVILLE, CAL.—Lumber for the construction of the first camp of the Great Western Power Company at the site of its proposed Caribou plant, two miles east of Belden, has been shipped from Oroville recently. It is expected that

construction work will be well under way this summer. The first dam is to be built near Sheep Rocks, four miles up the river from Copper City, and the second dam is to be 12 miles higher up near the mouth of Potem Creek.

SONORA, CAL.—Surveyors are busy contouring the proposed dam at the Priest portal of the 14-mile tunnel which is to be a part of San Francisco's aqueduct. The dam will be constructed of the material taken out of the tunnel and will be faced with concrete. From the dam at the tunnel a conduit will take the water to the proposed Moccasin creek electric generating plant, from which point it will be conveyed through a pipe line to the big city by the bay.

SAN FRANCISCO, CAL.—Lars R. Jorgensen, of San Francisco, has been granted by the State Water Commission the unappropriated flow to the extent of 50 cubic feet per second of the waters of the North Fork of North Fork, Yuba River, for power purposes. The permit also includes 100 cubic feet per second of the waters of the North Fork, Yuba River, tributary of Yuba River, Sierra county, for power purposes, and further water for agricultural purposes.

RIPON, CAL.—The New England California Corporation of Ripon has applied for 3 cubic feet per second of the waters of the Stanislaus River, San Joaquin county, tributary to the San Joaquin River, for agricultural purposes. The applicant will install a 6 inch centrifugal pump under a head of 42 ft. and divert water in three ditches, .4, .9 and 1.2 miles long. The amount of water to be stored is 9.21 acre feet. Water will be used on 2550 acres.

## THE PACIFIC SOUTHWEST

OXNARD, CAL.—The city trustees have voted to build a municipal gas plant, to cost $140,000.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation reports as its net income for the year ending Dec. 31, 1918, $733,130.

LOS ANGELES, CAL.—A fire in the Edison substation at El Camino Real and Beryle streets, Redondo Beach, damaged the building and apparatus to the extent of $4,000.

HERMOSA BEACH, CAL.—The Southern California Gas Company will extend mains between Camino Real and Prospect avenue, Pier avenue and 19th street. Work is to begin at once.

PASADENA, CAL.—The city commission voted unanimously to accept the bid of the department of public works of Los Angeles to supply electrical energy to Pasadena at wholesale prices for a term of 15 years.

VISTA, CAL.—At a meeting of property owners held at Vista it was decided to circulate a petition to form an irrigation district to comprise the lands between Oceanside and Escondido, tributary to the San Luis Rey river.

SAN PEDRO, CAL.—The Pacific Electric Railway Company is laying stakes for the proposed extension of the La Rambla car line which will be extended north in Bandini street to the canyon north of the Peck holdings.

SAN BERNARDINO, CAL.—The construction of the new power plant at Yellow Pine Mine will be commenced at once. Work in clearing ground of wreckage caused by fire has already been started. Mike Clooman of Utah will be the new mill foreman.

CALEXICO, CAL.—At a meeting of the board of trustees recently, reports were presented by W. G. Cross, of Olmsted & Gillilen, Los Angeles, regarding the gas and electric system contemplated. The plant would not cost over $165,000. The matter will be taken up at once.

BRAWLEY, CAL.—A committee of three has been appointed to bring matter before No. 8 Water Company and the Oakley Company relative to furnishing electricity for Westmorland from the plant that the water company contemplates putting in on the drop nearest to No. 8 corral.

LOS ANGELES, CAL.—Chief Electrical Engineer Scattergood of the Municipal Bureau of Power and Light has been authorized to lay before the consulting board of engineers the general plans for the power house and equipment for Power Plant No. 2, in San Francisquito Canyon, preliminary work upon which is now in progress.

LOS ANGELES, CAL.—Ralph Bennett, of Los Angeles, has applied for 200 second feet of the waters of Strawberry Creek and 600 second feet of the North Fork, San Jacinto River, also 200 second feet of Indian Creek, Riverside county, all tributary to San Jacinto River, for irrigation and power purposes. The applications provide for the storage of 50,000 acre feet per annum.

PASADENA, CAL.—Definite statement from F. D. Howell, engineer, as to cost of the proposed municipal railway gives the commission confidence that a $3,000,000 bond issue will be sufficient to purchase right-of-way, build and equip the line for operation. Chairman Hamilton states that the bonds will probably run for 30 years and bear interest at 5 per cent. The election was held on April 3rd.

EL CENTRO, CAL.—The Holton Power Company will install a new substation at Brawley, improved equipment at Holtville, and a new line between El Centro and Brawley, which will increase capacity 100%. The new station at Brawley will be of out-door type with steel structure and concrete forms, with a similarly constructed meter house. New regulators to handle the increased volume of power will be placed in the Calexico substation.

## THE INTER-MOUNTAIN DISTRICT

PROVO, UTAH.—The Beaver River Power Company has consolidated with the Southern Utah Power Company.

BRECKENRIDGE, COL.—The installation of an electric light plant is under consideration by the city of Breckenridge.

NUCLA, COL.—The installation of an electric light plant in Nucla is under consideration. Lincoln Vestal is interested.

CRAIG, COL.—Work will begin on the construction of the proposed new electric light plant as soon as the frost is out of the ground. Mr. Dutcher will have charge of the work.

WALLACE, IDA.—The power plant of the Federal Mining and Smelting Company near upper Burke was burned, entailing a loss estimated at $20,000. This plant had been used as an auxiliary.

MISSOULA, MONT.—Engineers have been engaged by the Missoula Light & Water Company for the purpose of having plans perfected for sluice gates at the company dam near Bonner, estimated cost being $50,000.

RONAN, MONT.—Stephen Walner of Butte is considering the establishment of a light and power plant here. Two years ago the citizens voted to grant a franchise, but the parties could not secure the needed equipment.

CUT BANK, MONT.—John Seal & Son have been granted a franchise to construct and operate an electric light plant in Cut Bank for a period of twenty-five years. It is expected to have at least one of the units in operation within sixty or ninety days.

PHOENIX, ARIZ.—The Superior Light & Power Company, having the same organization as the Superior Water Company, has been granted a certificate by the Corporation Commission to establish a power plant to supply electricity. Construction is to begin at once.

SEDGWICK, COL.—Plans are being prepared by the Henningson Engineering Company, National Bank Building, Omaha, Neb., for the construction of an electric light plant and waterworks in Sedgwick. An election will soon be called to vote on an issue of $30,000 in bonds for same.

VOYAGES home need to be paid for

—Victory Loan

THE VACUUM CLEANER —— THE VACUUM CLEANER

**CONVENTION PAPERS are important, of course, but who would miss the personal give and take of the smoking car and that mysterious back room (361 was the code at Riverside, wasn't it)? It is to preserve the conversational humanity of complete living that this page of the Journal of Electricity is regularly reserved and turned over to the office vacuum cleaner for the display of such bits as are collected in the daily round of the editorial rooms.—The Editor.**

A picture of a central station twenty seconds after the transmission lines went down—as witnessed by our secret agent. Emerson Esterling, electrical man of Ashland, Oregon, is the artist of this gem.

UGH-HUH. EH-A-AH.
MY LIGHTS ARE OUT! DO YOU KNOW WHEN THEY WILL BE ON? WHAT IS THE TROUBLE?
IT ISN'T OUR FAULT YOUR LIGHTS ARE OUT.
WITH
YES! THE POWER LINES BLEW DOWN! THEY MAY BE OUT FOR SOME TIME!! YES!
IT LOOKS LIKE WE COULD HAVE LIGHT AT LEAST ONE DAY OUT OF THE MONTH.
YES, I SENT MY MEN TO FIX 'M UP. ALRIGHT MRS.

Gas attacks are not confined to the war zone. Here are a few extracts—or whiffs—from a recent one directed to the recent gathering of the Pacific Coast Gas Association by the vice-president and manager of the Pacific Gas & Electric Company:

To the Members of the
Pacific Coast Gas Association
Assembled in solemn conclave
over the remains of hot birds
and cold water in Los Angeles — Greetings!

I sincerely regret that important engagements detaining me in the bucolic precincts of San Francisco, prevent a visit to the greater metropolis in the South; greater only, however, in its territorial confines.

It is a source of some satisfaction to me to know that among the natural gases in the Cafeteria of California, artificial gasers may meet around the same table and congratulate each other upon the fact that good old gas is still King.

There were days when it was doubtful whether gas could hold up its head and continue to assume its physical proportions in the face of the onslaughts made upon it by that weird creation of nature called electricity, which is much like the wind—"no man knoweth whither it cometh, or whither it goeth," and it is generally agreed that the windy suspirations of forced breath of the advocates of electricity are on all fours with the juice itself. My congratulations to the workers in the vineyard of gas, that have gathered its crops yearly without cessation, but not without effort. My advice is to stand by the guns and generate your retorts so that they will not need purification. But let us work in harmony withour younger brother, electricity, and show him the way from time to time.

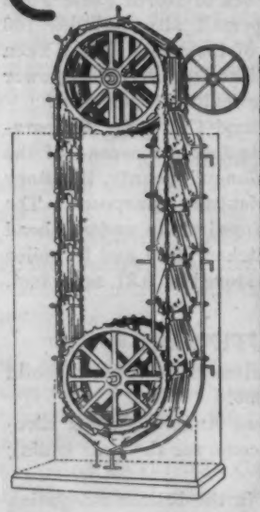
Gas as you may tonight, always remember that before you were it was, and will be, for nothing can change the eternal progress of that which lighted the way from wick to wicked.

Sincerely yours,

JOHN A. BRITTON.

**Not exactly perpetual motion** but something almost as good is promised by this little advertisement. Note that one drop of water every five minutes, a pint of water a day, will furnish plenty of power to light, heat and cook in a dwelling house of six or seven rooms. For all these virtues the owner pays not more than 50 cents a year. The fortunes to be made in this world-beating device will probably go far toward recouping the losses of the central stations who must undoubtedly go out of business with such disastrous competition.


**YOUR FUEL QUESTION SETTLED FOR ALL TIME BY A GREAT INVENTION**



**One Drop of Water Every Five Minutes—a Pint of Water a Day**

will furnish plenty of Power to LIGHT, HEAT AND COOK in a common dwelling house of six or seven rooms.

**Cost of Installation, about $250; Cost of Operation not to exceed 50 cents per year.**

Will last for many, many years.

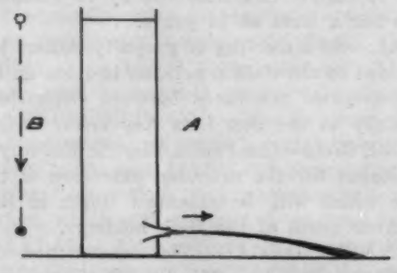
A Very Simple Mechanism When Once Understood

For further information call on Rufus Ames
532 ROOKERY BUILDING
SPOKANE, WASH.
Phone Main 5092
Open until 9:30

The illustration at the left represents one unit. Any number of units can be added, and improved, to obtain the results required.


## ENGINEERS OF YESTERDAY—7. TORRICELLI

**(A Series Compiled by A. L. Jordan)**




**How does the speed of the jet of water (A) compare with that of the ball (B) if the latter falls from a point on a level with the water surface?**

According to Torricelli's law they are the same, and about equal to eight times the square root of the height (in feet). Torricelli devised the scheme for measuring the "resistance of a vacuum" by a column of quicksilver and thus invented the mercury barometer (1643), the space at the top of which being still called the "Torricellian vacuum." He also investigated the mathematical relations of the curve called a cycloid and was the pupil of Galileo, as well as a real friend, who soothed and comforted the blind scientist in his last years.

THE VACUUM CLEANER —— THE VACUUM CLEANER